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SÉLARIÈS (P.). **Quelques notes sur la maladie verruqueuse de la Pomme de terre. Synchytrium endobioticum (Schilb.) Perc.** [Notes on Potato wart disease. *Synchytrium endobioticum* (Schilb.) Perc.]—*Ann. Épiphyt.*, N.S., 13, pp. 102–105, 1947. [Received December, 1948.]

In an experiment carried out in Alsace in October, 1943, potato wart [*Synchytrium endobioticum*: see next abstract] galls of the same origin were placed in wooden boxes, one box being kept in the laboratory, the second outside but under shelter, and the third outside and not under shelter (except from rain). Early in January, sporangia were collected and placed in a damp chamber, the three lots giving, respectively, after 65 days, 26, 27, and 29 per cent. germination. In the autumn also, another box filled with galls was left outside, but sheltered from rain. Specimens were taken in January at depths of (*a*) down to 5 c.m., (*b*) 5 to 10 cm., and (*c*) 10 to 22 cm. (bottom of box). The percentages of empty sporangia found for the three depths were, respectively, 79·09, 41·89, and 8·24, which gives a general average, taking depth into account, of 31·99 per cent. The sporangia on the surface evidently developed rapidly, those in the deeper layers but slowly.

Examination of 1,000 sporangia taken from warted growths each fortnight showed that zoospore emission was nil in October, very slight in November, and became appreciable only at the end of December. In further tests zoospore emission was found to be moderately regular, slow at first but increasing rapidly after seven weeks.

On 13th January, sporangia were extracted from a soil sample and 68 per cent. were found to be 'full'. On 26th March the figure was 14·86 per cent., 53 per cent. having liberated zoospores.

Examination of sand used for three years in artificial infection experiments showed that from 60 to 80 (average about 75) per cent. of the sporangia were empty, and about one-third of the remaining 25 per cent. were 'dead' when tested with acid fuchsin [cf. *R.A.M.*, 4, p. 501]. In spite of this, the sand caused infection in the 5 out of 25 shoots of the susceptible Wohltmann variety.

Galls collected in the autumn of 1942 and kept outdoors under shelter gave 44 per cent. zoospore emission in 1944.

SÉLARIÈS (P.). **Recherche des sporanges quiescents du Synchytrium endobioticum (Schilb.) Perc. dans un terrain infecté.** [The search for resting sporangia of *Synchytrium endobioticum* (Schilb.) Perc. in an infected soil.]—*Ann. Épiphyt.*, N.S., 13, pp. 107–117, 1947. [Received December, 1948.]

The author carried out preliminary experiments at Clermont-Ferrand to devise a method for isolating resting sporangia of potato wart (*Synchytrium endobioticum*) from soil and testing their viability. Tests of the method used by Schander and Richter [*R.A.M.*, 2, p. 575] showed that the one minute's rest for the test tube containing the soil and water was too long, as it allowed most of the sporangia to fall to the bottom of the tube. It was found that 15 seconds are enough to allow the

large particles of soil to fall, that even in this short time many sporangia fall to the bottom, and that eight to ten extractions are essential to recover almost all the sporangia.

The results of further tests of the method in Alsace, allowing 15 and 5 seconds' rest, showed that it provides a rapid means of determining whether a soil is infected, but does not allow nearly all the sporangia to be extracted. Twenty extractions were found necessary for this, with as short a resting-time as possible.

In tests of Miss Glynne's method [ibid., 15, p. 601], using carbon tetrachloride of density 1·6, most of the sporangia fell to the bottom of the tube almost as quickly as the soil. An adaptation of this method using liquids with densities from 1·8 to 2·6 gave a similar result.

Finally, the author took soil samples from ten different places in the field, mixed them thoroughly, and selected an average sample. After removal of the larger solids the soil was ground up and sifted. One gm. of this, dried in the air, was placed in a test tube, and the sporangia extracted by successive decantations. To eliminate most of the colloids the first 20 c.c. of water added were decanted after 20 minutes' rest and left to settle for 24 hours. Decantation then gave deposit B. The first deposit (A), left in the tube, was exhausted by 20 successive decantations, ten after 15 seconds' rest and ten after 5; all the liquids were collected and allowed to rest for 24 hours, and after decantation deposit C was obtained. Three c.c. were left in the tube, i.e., about 50 drops. Microscopic examination gave for deposit B 18 sporangia per 25 drops and for C 247 for 25 drops, a total equivalent to 530 for 100 drops. Five further extractions from deposit A gave 11 sporangia and another five gave one more, so that one gm. of soil gave in all 542 sporangia.

Examination of 60,210 sporangia taken from this soil, which had not been planted to a susceptible host for six years, showed that of this number only 120 had not emitted zoospores, i.e., only one had failed to germinate for every 500 that had; thus in an average gm. of soil only one sporangium had not germinated. In spite of a dry season, infection in this field in 1946 was massive and general.

Ollila (Laila). **Perunasyöpä.** [Potato wart disease.]—*Valt. Maatalousk. Tiedon.* 218, 8 pp., 2 figs., 1 map, 1949. [English summary.]

The symptomatology and life-history of *Synchytrium endobioticum*, the agent of potato wart disease, are described, and a list is given of current immune varieties, the only ones authorized for cultivation in the areas declared to be infected in Finland [*R.A.M.*, 15, p. 464].

Koblet (R.). **Untersuchungen über den Einfluss der Stickstoffdüngung auf den Krankheitsbefall und die Speisequalität der Kartoffel. II. Die chemische Zusammensetzung der Ernte und ihre Beziehung zum Auftreten von Knollenkrankheiten.** [Investigations on the influence of nitrogen manuring on the incidence of disease and palatability of the Potato. II. The chemical composition of the crop and its relation to the occurrence of tuber diseases.]—*Annu. agric. Suisse*, 49, 10–11, pp. 827–847, 2 diags., 1948. [French summary.]

The effect on the nitrogen content of the tubers of Swiss potato crops given, from 1943 to 1946, increasing amounts of calcium nitrate as a supplement to a basic fertilizer, varied with the season and localities [*R.A.M.*, 28, p. 81], but in the majority of the trials there was a more or less extensive increase in the nitrogen content of the tubers.

From the observations of other workers a rise in the incidence of the tuber rot caused by *Phytophthora infestans* was to be expected in consequence of the increase in non-protein or amino nitrogen frequently produced by the calcium nitrate supplements. Only isolated cases of infection from this source occurred in the storehouses, however, but in inoculation experiments by H. Hänni (forming part of a

comprehensive study on *Phytophthora infestans* intended for publication shortly) on two of the test lots, the fungus spread more rapidly at 18° C. in the tubers receiving the higher calcium nitrate dosages of 60 and 90 kg. per ha. than in those given only 30 kg. or none, whereas at 21° the differences between the treatments were not significant. Probably, therefore, the practical effects of nitrogenous manuring on the incidence of tuber rot under normal storage conditions would be negligible.

Reference has already been made [loc. cit.] to the absence of any connexion between the calcium nitrate treatments and the development of 'Eisenfleckigkeit' [internal rust spot], and to their tendency to aggravate blackening on cooking in the susceptible Voran.

Mills (W. R.) & Peterson (L. C.). **Potato blight investigations.**—Abs. in *Amer. Potato J.*, **26**, 3, p. 98, 1949.

Several new races of *Phytophthora infestans* [*R.A.M.*, **28**, pp. 352, 414] have been isolated from potato seedlings of many new varieties, hitherto considered as immune, growing on plots concerned with the development of blight-resistant varieties. Many seedlings, when inoculated at weekly intervals with the prevalent field culture, gave continuous immune reactions, while others exhibited the first symptoms after 70 days. Virulent cultures were obtained by culturing the organism from some of the largest lesions and by repeating the inoculations on the plant in question. The immunity of *Solanum demissum* [ibid., **28**, p. 76] to all known races of *P. infestans* has been confirmed, and it has been demonstrated that several genes are concerned in resistance to the fungus.

Callbeck (L. C.). **Results of spraying and dusting Potatoes for late blight.**—Abs. in *Amer. Potato J.*, **26**, 3, pp. 91–92, 1949.

Two experiments were carried out in Prince Edward Island in 1948 on Green Mountain potatoes, (1) to study the fungicidal effect of eight spray materials on blight [*Phytophthora infestans*: see preceding and next abstracts] and on yield, and (2) to compare wet and dry applications of fungicides. The plots were sprinkled several times in August with water suspensions of *P. infestans*, and seven applications of the fungicides were made. The results of the first experiment demonstrated that the copper sprays Bordeaux (4–2–40), bordow (8–40), COCS [copper oxychloride sulphate] niatox (4–40), and deecop (3–40) were approximately equally effective in controlling the disease on the foliage, the first two being slightly superior to the latter. Tuber rot losses were smallest in plots sprayed with Bordeaux mixture. Parzate (1–40) and phygon XL (1–40) gave the best control (the latter delaying maturity), while dithane (1 qt.+0·5 lb. zinc sulphate—0·25 lb. lime–40) was inferior to the copper sprays. Plots treated with COCS niatox, bordow, parzate, Bordeaux, dithane, deecop, and phygon yielded 299·1, 294·3, 290·8, 275·4, 257·6, 255·1, and 254·6 bush. per acre, respectively, the untreated control 199·5.

In the second experiment in which copper sulphate–lime, copper oxychloride sulphate, and tetra copper calcium oxychloride were compared, the losses due to blight tuber rot were 3 [bush.] per acre for the sprayed plots, 5·4 for the dusted, and 6·4 for the untreated controls, and the yields were 255, 225·7, and 129·1 bush., respectively.

Callbeck (L. C.). **Late blight epidemiology studies in Prince Edward Island.**—Abs. in *Proc. Canad. phytopath. Soc.*, **16**, pp. 13–14, 1949.

The rainfall record during the growing season of potatoes has not been a reliable factor for forecasting outbreaks of blight (*Phytophthora infestans*) [see next abstract] in Prince Edward Island, Canada, severe epiphytotics of which have occurred during 13 of the last 26 years. Storage losses due to blight tuber rot are mainly

caused by harvesting while the vines are still green or too soon after their death. The author advises the use of vine killers and harvesting about two weeks after the plants have died.

NUGENT (T. J.). **When is the right time to spray? Research results in forecasting fungicide applications for controlling late blight.**—*Food Packer*, 30, 6, pp. 34, 36, 2 graphs, 1949.

The critical period for potato and tomato blight [*Phytophthora infestans*] development in eastern Virginia begins about 8th May and continues until mid-June. Forecasts to growers [cf. *R.A.M.*, 26, p. 210; 27, pp. 49, 437 and next abstract] are based on the moving seven-day average mean temperatures and cumulative rainfall, which are plotted on a chart starting on 8th May. During the critical period the average mean temperatures are normally conducive (below 75° F.) to the disease, and the amount of rainfall is therefore the determining factor in the production of conditions favourable to its occurrence. By the end of June temperatures are normally high enough (above 75°) to arrest the spread of infection irrespective of the extent of precipitation.

In 1948, the seven-day mean average temperatures for the week of 10th to 17th May ranged from 64° to 73°, and approximately 2½ in. rain fell in the Norfolk district and the Cape Charles area on the eastern shore. The cumulative rainfall for Norfolk exceeded the critical line on 13th May and was considerably above it by the 17th, and warnings were issued on the latter date. During the week of 18th to 25th, the temperatures remained favourable (66° to 71°), but no rain fell. Blight appeared between 22nd and 24th, but was mostly confined to fields with poor air drainage. The second warning was released on the 26th, between which date and 1st June about 4 in. rain fell. On the 9th favourable conditions for blight were still persisting, but two days later the mean temperatures in the vicinity of Norfolk reached the critical line (75°), where they remained within a degree above or below until the 24th, when an appreciable rise occurred and was maintained for some time. These temperatures prevented the development of a serious outbreak like that of 1946. Along the eastern shore the disease did not develop to any extent owing to the comparatively low rainfall, which at no time exceeded the critical line, but the potential threat was sufficiently grave to justify the application of control measures throughout eastern Virginia.

MILLER (P. R.) & O'BRIEN (MURIEL). **The warning service in 1948. Tobacco blue mold—Potato and Tomato late blight—Cucurbit downy mildew.**—*Plant Dis. Reptr, Suppl.* 178, pp. 171–291, 2 graphs, 10 maps, 1948. [Mimeographed.]

Reports received from different parts of Canada and the United States on the spread of potato and tomato late blight (*Phytophthora infestans*), tobacco blue mould (*Peronospora tabacina*), and cucurbit downy mildew (*Pseudoperonospora cubensis*) during 1948 are presented. It is hoped that in later years these reports, together with epidemiological studies, will furnish a basis for forecasting outbreaks of disease and recommending suitable control [*R.A.M.*, 27, p. 292 and preceding abstract].

Spread of tomato late blight was reported from aerial spore showers blown from infected potato plants and cull piles to tomatoes in adjacent fields, and from blight carried into northern regions on apparently healthy tomato transplants from Tifton, Georgia. The disease was on the whole more severe than in 1947 and, perhaps, more scattered, but followed a line along the Atlantic seaboard and spread into the tomato canning acreage in some mid-western States. Losses ranged from 2 to 40 per cent. of the acreage planted, but generally speaking were not severe. Fixed coppers, dithane, Bordeaux, zerlate, and parzate, used as sprays, and neutral coppers, Bordeaux, phygon, dithane, D-14–zinc sulphate–lime, parzate, and zerlate [ibid., 28, pp. 36,

146], used as dusts, were employed by 10 to 80 per cent. of the growers, using ground machines or aeroplanes. Effectiveness seemed to be governed by time and regularity of application and the coverage obtained rather than by the material itself.

Potato late blight appeared in the autumn crop in Louisiana, and in December in Florida; it was active intermittently over an extended period, depending more on nights of heavy dew and cooler temperatures for its development and spread than on heavy rain. In some cases infection arose from cull piles, diseased 'seed', and affected tomato plantings. It was not severe, though present along the eastern seaboard and reported in Minnesota, Iowa, Colorado, Manitoba, eastern Canada, and in an isolated area in British Columbia; losses ranged from one to 20 per cent.

Tobacco blue mould was generally distributed along the Atlantic coast, but infection was nowhere very severe. It was first observed late in February in northern Florida, became prevalent in southern Georgia between early February and 15th April, was reported from Tennessee in mid-April, from South Carolina about 15th March, from Kentucky at the end of April, from Canada in May, and from Pennsylvania on 4th August. The general evidence strongly indicated that infection from oospores was the initial cause of most outbreaks [ibid., 27, p. 163], which were checked by hot, dry weather or, when the weather favoured the disease, by applications of fungicides, particularly dithiocarbamates.

Downy mildew appeared on squash and cucumber plantings in early February in frost-free areas in coastal south Florida, slowly spreading along the eastern seaboard to the Virginia State line, where its development became arrested by dry weather. After an interval of three weeks it gradually moved north, though as harvesting was already in progress it caused little damage. Losses were low, copper sprays and biscarbamates apparently keeping infection down [ibid., 27, p. 506].

[An account of this work is also given by Miller (P. R.), Wood (J. I.), & O'Brien (M. J.) in *Agric. Chemicals*, 3, 11, pp. 28–31, 63, 65–66 B, 2 maps, 1948.]

Atkinson (R. G.) & Rovatt (J. W.). **The effect of the incorporation of certain cover crops on the microflora of Potato-scab-infested soil.**—Abs. in *Proc. Canad. phytopath. Soc.*, 16, p. 15, 1949.

The addition of soy-bean crops to soil infested with scab [*Actinomyces scabies*: *R.A.M.*, 27, p. 540] resulted in a marked reduction of the disease in potato tubers; the acidity of the soil increased, and there was a striking reduction in numbers of actinomycetes on the tubers.

Vinot (M.) & Bernaux (P.). **La pourriture charbonneuse de la Pomme de terre dans la région Méditerranéenne. (Macrophomina phaseoli [Maublanc] Ashby).** [Potato charcoal rot in the Mediterranean region. (*Macrophomina phaseoli* (Maublanc) Ashby).]—*Ann. Épiphyt.*, N.S., 14, pp. 91–102, 5 figs., 2 graphs, 1 map, 1948.

Potato charcoal rot (*Macrophomina phaseoli*) [*R.A.M.*, 27, p. 536] has been observed in recent years in the hottest parts of the Mediterranean coastal region of France during summer. In July, 1943, it occurred in the vicinity of Antibes and Grasse, and it has been noted in the same locality every year since at about the same time, being common in domestic gardens. In 1947, it was found at Antibes on eggplant and chilli in association with *Fusarium* or *Phytophthora*, while it was also observed on *Gilia coronopifolia*.

From the first, the outbreaks were very serious, the losses in crops dug in July or early August being well over 50 per cent., while the remainder of the crop was in many instances destroyed by *Fusarium* spp. The Institut de Beauvais, Bintje, and Royal Kidney varieties showed no appreciable difference in susceptibility,

though the secondary lesions appeared to develop somewhat more rapidly on Institut de Beauvais than on the other two.

In culture, optimum growth occurred at 37° C. while 40° appeared to be lethal; at 17° growth was very feeble. Experimental inoculations of Bintje tubers afterwards placed in a damp chamber showed that at 25° infection developed very slowly, while at 35° it was rapid. After a week at the latter temperature infection was complete and the tubers had started to rot, presenting the same appearance as affected potatoes found in the field.

In 1943, when part of a crop was lifted a fortnight before normal maturity, healthy tubers were obtained, though the remainder subsequently showed 60 to 70 per cent. infection [cf. ibid., 24, p. 202]. The heaviest damage was found on Royal Kidney dug up a fortnight after maturity and, regularly, at Grasse, on Beauvais dug up at maturity. At Grasse, a severe outbreak occurred on a crop of Royal Kidney which had not been watered for a month [cf. ibid., 23, p. 187]. Early varieties, planted and dug up early, should be grown.

Richardson (L. T.) & Goodin (R. E.). **Five years of bacterial ring rot.**—*Amer. Potato J.*, 26, 3, pp. 85–89, 1949.

The results of potato surveys made each year since 1943 in Ontario indicated that with the exception of the 1946 season the percentage of farms and acreage infected with bacterial ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, 27, p. 554] has decreased since the first survey, the percentages of infected farms for 1943 to 1947 inclusive being 17, 15, 9, 21, and 11. In 1947 the infection rate in the majority of fields inspected was very low, often only a trace. An increasing number of growers succeeded in eliminating the disease from their farms, and on the whole the outlook for ring rot control appears to be promising.

Baldacci (E.). **La temperatura come fattore limite degli attacchi di Helminthosporium oryzae.** [The temperature as a limiting factor in attacks by *Helminthosporium oryzae*.]—*Risicolt.*, 35, 10, pp. 196–198, 1947. [Received May, 1949.]

Rice seedlings grown from ears infected with *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: *R.A.M.*, 27, p. 335; 28, pp. 238, 239] develop typical leaf spots and withering and blackening of the cotyledon tips when kept at a relative humidity of above 80 per cent. At six locations in Italy during April and May it was found that the disease does not occur during the initial growth of the plant because the average temperature is below the minimum (18° C.) required for germination and invasion of the tissues by the parasite. This average is usually reached in June, corresponding with the appearance of *H. oryzae*. The means by which the disease perennates from one year to the next has yet to be determined. Investigations have shown that leaf spots are consistently present on adult plants in Italian nurseries, but only under favourable conditions do they affect the culms and rachides causing severe damage.

Baldacci (E.) & Picco (D.). **Osservazioni sulle malattie del Riso durante gli anni 1946 e 1947.** [Observations on Rice diseases during the years 1946 and 1947.] —*Risicolt.*, 36, pp. 73–77, 113–117, 1 fig., 1948.

During 1946, rice growing in the valley of the Po, in Lomellina, Vercelli, and in part of Novara, Italy, was attacked in epidemic proportions by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: see preceding abstract] and *Piricularia oryzae* [*R.A.M.*, 28, pp. 29, 239]; the former appeared to be the more prevalent, probably because it is endemic locally. Losses ranged from 30 to 70 per cent., and in one case (taking lodging into account) up to 90 per cent. The outbreak was favoured by the

rich meadow-land to which the rice was transplanted and by the climatic conditions which prevailed after flowering.

In 1945, when no epidemic occurred, very little rain fell during July, but rain was abundant and evenly distributed in August, and September was very dry, whereas in 1946 copious rain fell during July and in August (mostly between the 19th and the 31st), and slight rains continued to fall during the first ten days of September. Temperature also was higher in August (19th to 26th) 1945 than in 1946.

As the optimum temperature for infection by *O. miyabeanus* is between 20° and 25° C. and for *P. oryzae* about 20°, the effect of the low temperatures in the second half of August, 1946, was to weaken the plants rather than to favour the parasites, though the rain exercised this latter effect. Wind and hail also damaged the crop, entry of the fungi being facilitated by the lesions caused.

When a sample of rice was examined by the naked eye 50 to 55 per cent. of the spikelets showed spotting, and on incubation in a damp chamber 23·4 per cent. of the spotted spikelets gave *O. miyabeanus*, 13·4 *Alternaria* sp., 4·9 *Epicoccum purpurascens* [ibid., 26, p. 267], 4·9 *Penicillium* spp., 1·2 *Fusarium* spp., 1·2 *Cephalosporium* sp., 19·7 sterile species, while 30·8 per cent. gave no fungus.

Bibliography of the literature on sodium and iodine in relation to plant and animal nutrition. First edition. Volume I.—237 pp., Chile Nitrate Educational Bureau, Inc., 120 Broadway, New York, 1948.

This useful publication comprises annotations or abstracts of the literature on sodium and iodine in relation to plant and animal nutrition. A few of the papers deal with subjects of phytopathological interest. Indices of authors, elements, plants, and general nutrition are appended [cf. *R.A.M.*, 26, p. 213].

Roy (T. C.). **Anthracnose of Piper betle L. caused by Colletotrichum dasturii Roy sp. nov. in Bengal.**—*J. Indian bot. Soc.*, 27, 2–3, pp. 96–102, 1 fig., 1 graph, 1948.

An epidemic of anthracnose caused heavy losses in *Piper betle* plantations at Dacca, Bengal, in 1946. The disease, which has become increasingly troublesome of recent years, appears soon after the outbreak of rains in April and reaches its maximum intensity from May to July. Infection may occur at any part of the stem, the initial small, black, circular lesions expanding rapidly under very humid conditions, sometimes encircling the stem completely and causing wilting of the plant. In dry weather long, narrow, vertical discolorations are seen on the stem, while in cases of advanced infection depressions appear at the site of invasion and the internodes are constricted. Shredding of the cortex may expose the inner fibro-vascular tissues. Acervuli develop as black specks on dead parts of the stems and branches. On the leaves the spots are usually circular, with a brownish-black centre and a yellowish halo, coalescing freely to form larger lesions. When the margins are involved the leaf blades tend to droop owing to shrinkage of the tissues. Diseased leaves often fall prematurely. Among many varieties tested at the Government Farm for their reaction to anthracnose, Kankar showed a high degree of resistance, while Dholdog was very susceptible.

The morphological characters of the fungus associated with the disease are discussed and tabulated in comparison with those of *Colletotrichum piperis* Petch (*Ann. R. bot. Gdns Peradeniya*, 4, p. 237, 1917), *C. piperis* Stevens (*Trans. Ill. Acad. Sci.*, 10, p. 198, 1917), and two *C.* spp. reported by Dastur [*R.A.M.*, 14, p. 718]. The differences in the size and shape of the conidia between the Bengal fungus and the other species would seem to entitle the former to specific rank, and it is accordingly described as *C. dasturii* n. sp. The numerous setae on the margins of the acervuli are septate, each with a swollen basal cell, and measure 110·4 to 360 by 3·4 to 4·6 (average 136·7 by 4·2) μ; the continuous, hyaline, mostly falcate

conidia, 19·4 to 25·1 by 2·3 to 3·4 (23·1 by 3) μ, are borne on simple, straight, hyaline to light brown conidiophores, densely aggregated in the centre of the acervuli.

Annual Report of the Department of Science and Agriculture, Barbados, for the year 1947–1948.—83 pp., 1948.

The following references to sugar-cane mosaic virus occur in this report [cf. *R.A.M.*, 25, p. 279; 27, p. 157]. In an experiment designed by B. de L. Inniss (p. 37) to test the effect of temperature at the time of inoculation on the 'take' of the virus, plants of the Ba. 11569 series were inoculated at 30° to 36° C., resulting in a maximum incidence (56 per cent.) at 33° and a minimum (11 per cent.) at 31° and 36°.

D. R. D. Wiles notes on p. 60 that, in accordance with the Mosaic Disease (Eradication) Act, 1943, 315 returns were received during the year, revealing the presence of 1,280 infected holes, which were destroyed; they were scattered over six parishes. The number of infections has been greatly reduced by the careful selection of planting material and the increasing use of the highly resistant variety B. 37161.

Mayor (E.) & Viennot-Bourgin (G.). **Contribution a l'étude des Micromycètes de Languedoc et de Provence.** [A contribution to the study of the microfungi of Languedoc and Provence.]—*Rev. Path. vég.*, 28, 1, pp. 29–53, 3 pls., 1949.

This is an annotated list (arranged under the localities concerned) of microfungi (rare or new to science) collected on forays made during June, 1948, in different parts of Languedoc and Provence. The article concludes with a list of leguminous plants on which species of *Uromyces*, morphologically related to *U. anthyllidis*, have been recorded.

Baker (R. E. D.) & Dale (W. T.). **Fungi of Barbados and the Windward Islands.**—*Mycol. Pap., Commonw. mycol. Inst.*, 25, 26 pp., 1948. 3*s.* 9*d.*

This first, annotated list of fungi containing, *inter alia*, species of rusts, *Phyllachora*, and *Cercospora* from Barbados and the Windward Islands, is based on collections made from 1944 to 1947, inclusive. The list is arranged taxonomically, and indexes to the hosts and fungi are provided.

Möller (F. H.). **Fungi of the Faeröes. Part I. Basidiomycetes.**—295 pp., 3 col. pls., 134 figs., 1 col. map, Copenhagen, Einar Munksgaard, 1945. [Received June, 1949.] Dan. Kr. 20.

This critically annotated list of over 200 Basidiomycetes, including a large number of new species, combinations, varieties, and forms collected in the Faeröes from mid-June to mid-September, 1938, is preceded by a general part comprising, *inter alia*, historical notes on the mycological investigation of the Islands; observations on material and technique; and accounts of the distribution of Basidiomycetes on the individual islands. Among the species of economic importance may be mentioned *Ustilago avenae* on oats, *U. nuda* on barley, and *Melampsora lini* on *Linum catharticum* [*R.A.M.*, 24, p. 387]. An eight-page bibliography is appended.

Ramakrishnan (T. S.) & Ramakrishnan (K.). **Additions to fungi of Madras—VI.**—*Proc. Indian Acad. Sci.*, Sect. B, 29, 2, pp. 48–58, 1 pl., 1949.

This further instalment of the authors' critically annotated list of Madras fungi [*R.A.M.*, 28, p. 32] comprises nine species, of which eight are new.

Da Costa (G. C.) & Mundkur (B. B.). **A revision of the genus Phyllosticta in India.** —*Proc. nat. Inst. Sci. India*, 14, 2, pp. 55–63, 1948.

The authors list 60 species of *Phyllosticta* for India. Of these seven are new records, including *P. caricae-papayae* on papaw in Bihar [*R.A.M.*, 23, p. 492] and *P. cucurbitacearum* [ibid., 10, p. 501] on *Cucurbita* sp. at Hyderabad.

Groves (J. W.) & Leach (A. Mavis). **The species of Tympanis occurring on Pinus.** —*Mycologia*, 41, 1, pp. 59–76, 1 pl., 3 figs., 1949.

The species of *Tympanis* occurring on conifers have been greatly confused in literature. Thirteen have been reported on pine, whereas the authors consider that there are only three, mainly distinguishable by the character of the primary ascospores. Those of *T. hypopodia* [*R.A.M.*, 22, p. 46] are fusiform, uni- or bicellular; this species is also distinguished by the small size of the asci. *T. pithya* has ellipsoid to subglobose primary ascospores, while those of *T. confusa*, the agent of canker in red pine [*Pinus resinosa*: ibid., 16, p. 289; 18, p. 217] are elongate-fusiform to clavate-fusiform and uni- to multicellular. The sizes of the asci in the latter two species are almost identical, although those of *T. confusa* tend to be slightly smaller. Full technical descriptions of the three species are given. *T. confusa* was found on *P. resinosa* [loc. cit.], *P. strobus*, *P. albicaulis*, *P. monticola*, *P. contorta*, and *P. sylvestris*.

[An abstract of this work appeared in *Proc. Canad. phytopath. Soc.*, 16, p. 10, 1949.]

Lowe (J. L.). **Studies in the genus Poria. I. Poria carneopallens (Berk.) Cooke.**— *Pap. Mich. Acad. Sci.*, 32 (1946), Part I, pp. 99–101, 1 fig., 1948.

A study of material of the genus *Poria* [*R.A.M.*, 28, p. 361] in the Farlow Herbarium showed that a positive distinction between *P. carneopallens* and *P. eupora* is the absence of clamp connexions in the thin-walled connective hyphae in the subiculum of the former and their presence in the latter. A complete, modern description of *P. carneopallens* is given.

Steyaert (R. L.). **Contribution a l'étude monographique de Pestalotia de Not. et Monochaetia Sacc. (Truncatella gen. nov. et Pestalotiopsis gen. nov.).** [Contribution to the monographic study of *Pestalotia* de Not. and *Monochaetia* Sacc. (*Truncatella* n.g. and *Pestalotiopsis* n.g.).]—*Bull. Jard. bot. Brux.*, 19, 3, pp. 285–354, 17 pl., 5 figs., 1949.

The results of the author's intensive studies on his abundant material of *Pestalotia* collected in the Belgian Congo [*R.A.M.*, 28, p. 247] are presented in the form of a partial revision of the genus [cf. ibid., 12, p. 57]. *Pestalotia* is furnished with an emended diagnosis (in which the coloured middle portion of the conidium is stated to be divided into four locules, not cells, by rings forming pseudo-septa) and left with a single representative, *P. pezoides*, while two new genera, *Truncatella* and *Pestalotiopsis*, are erected for the accommodation of the remaining species with tri- and quadriseptate conidia, respectively. Saccardo's genus *Monochaetia*, comprising the species with unisetulate conidia, is not accepted.

Among the new combinations resulting from the reclassification are *T. hartigi* [ibid., 25, p. 19], *P. gracilis* [ibid., 15, p. 593], *P. paeoniae* [ibid., 17, p. 348], *P. guepini* [ibid., 1, p. 413; 26, p. 330], *P. mangiferae* [ibid., 28, p. 247], *P. aeruginea* [loc. cit.], *P. palmarum* [ibid., 1, p. 413; 26, p. 104], *P. theae* [ibid., 27, p. 464] and its var. *minor* [ibid., 28, p. 247], *P. versicolor* [ibid., 15, p. 593], and *P. funerea* [ibid., 27, p. 455]. The list further contains seven new species.

GREGORY (P. H.). **Studies on Sclerotinia and Botrytis. II. De Bary's description and specimens of Peziza fuckeliana.**—*Trans. Brit. mycol. Soc.*, 32, 1, pp. 1–10, 3 pls., 1 fig., 1949.

Continuing his earlier studies [*R.A.M.*, 20, p. 466], the author after pointing out that interest in *Sclerotinia fuckeliana*, described by de Bary as the perfect state of *Botrytis cinerea* on vine, is revived by the production of apothecia in pure cultures by Drayton and Groves [ibid., 18, p. 820], cites the various descriptions of this fungus on various hosts, including a detailed account and a figure by de Bary which appear to have been overlooked. Dr. Ramsbottom also drew the author's attention to a slide of de Bary's in the British Museum (Natural History) with sections of apothecia labelled '*Peziza fuckeliana*, 22–10–64'. This must constitute the type specimen. Photographs of this slide are given. The information now available should help to determine the systematic position of apothecia produced in pure culture.

VALENTA (V.). **Notes on Verticillium cinnabarinum.**—*Studia bot. čechosl.*, 9, 2–4, pp. 160–173, 2 figs., 1948.

The author reviews the genera *Verticillium* and *Acrostalagmus* with special reference to the groups *lateritium* and *cinnabarinum* and some miscellaneous species. He concludes that *V. cinnabarinum* and *V. affine* are synonyms of *V. lateritium* (the imperfect state of *Nectria inventa*), for which he gives a new Latin diagnosis, and suggests that the names *Acrostalagmus cinnabarinus* var. *hyalocephalus* Dem. and *A. cinnabarinus* f. *minimus* be dropped.

The pathogenicity of *V. lateritium* [*R.A.M.*, 5, p. 13; 8, p. 238] remains to be established.

TUBBS (F. R.). **Report of the Pathologist for 1947.**—*Bull. Tea Res. Inst. Ceylon* 29, pp. 23–25, [? 1949.]

In this report [cf. *R.A.M.*, 27, p. 297] it is stated that ten years' accurate records kept at St. Coombs, Ceylon, show conclusively that the removal of dead and dying tea bushes is insufficient by itself to check root disease due to *Poria* [*hypolateritia*: loc. cit.]. Only the removal of every bush showing any trace of infection and of a complete ring of apparently healthy bushes round them is sufficiently effective to justify the amount of labour involved. In affected areas treated in this way no further trouble has been experienced, but wherever less radical methods have been employed the disease has caused continued losses and heavy and unnecessary expense in further treatment.

On p. 35 it is stated that the occurrence under field conditions of some bushes which, while not immune from blister blight [*Exobasidium vexans*: ibid., 27, p. 389] yet appeared very resistant, while others were very susceptible, led to a careful examination of the susceptibility of the St. Coombs' tea clones under comparable field conditions during the south-west monsoon. The number of blisters per bush or even percentage of bushes infected provides a rough indication of degree of resistance. A table is given showing the 'order of merit' of the different clones in this respect as based on the number of blisters (1) per unit weight of crop and (2) per unit number of flush. The mean of these provides the most satisfactory field measure of resistance at present available and gives some guide to further selection. Yield, however, still remains the essential criterion. Clone 1114, for example, gave a good yield in 1947 in spite of its relative susceptibility. Of the pre-1947 selections, clone No. 1526 appeared to combine high levels of quality, yield, and blister resistance.

Selection of mother bushes on a basis of apparent resistance was carried out in 1947 in a field badly affected after pruning. Of nearly 49,000 bushes, 21 were

found on which traces of lesions were absent or very scarce. These provide the basis of a new multiplication area planted out in 1947, which includes 18 further clones received from estates and believed to be resistant, and three of the older series (1526, 777, and 1114) for comparative purposes.

VALLEAU (W. D.). **The genetics of mosaic resistance in Nicotiana glutinosa.**—*J. agric. Res.*, 78, 3–4, pp. 77–79, 1949.

Breeding experiments at the Kentucky Agricultural Experiment Station showed that the Ambalema type of mosaic-resistant Burley tobacco [*R.A.M.*, 28, p. 327] evidently does not contain any factors (A_1 A_2) for mosaic susceptibility. *Nicotiana glutinosa* contains the *N* or necrotic spotting factor, but when grown at 97° F. develops typical mosaic mottling. Thus *N. glutinosa* contains not only the dominant *N* factor for necrotic spotting but also a dominant factor for susceptibility to mosaic. Mosaic-resistant tobacco varieties containing the *N* factor are essentially mosaic-susceptible varieties with the *N* factor probably substituted for the *N'* or n'^6 factor of *N. tabacum*. Otherwise the genetic composition appears to be identical with that of ordinary susceptible varieties of *N. tabacum*. A variety genetically designated $NNa_1a_1a_2a_2$ should be virtually immune from mosaic because necrotic spots should develop so slowly that localization would be complete. This combination is still in the process of development.

SHARP (D. G.) & WOLF (F. A.). **The virus of Tobacco leaf curl.**—*Phytopathology*, 39, 3, pp. 225–230, 2 figs., 1 diag., 1 graph, 1949.

The tobacco leaf curl virus causes one of the most serious diseases of the crop in Venezuela. The material used in the writers' studies at Duke University, Durham, North Carolina, on the physical characteristics of the virus, consisted of formolized sap from the young leaves of infected plants grown in the State of Aragua, the importation into the United States of living diseased plants being prohibited. The sap was examined under the electron microscope, both in the crude state and after concentration and partial purification with the ultracentrifuge. All the preparations were found to contain rod-like particles, up to 1,144 mμ in length, with a strong maximum at 277 mμ (285 mμ in electron micrographs shadowed with gold), and about 15 mμ in width.

The average sedimentation rate of the virus approximates to 171×10^{-13}, which falls within the range of variation in rate for the tobacco mosaic virus [*R.A.M.*, 16, p. 415]. There is also a close morphological similarity between the rod-shaped particles of these two viruses [ibid., 26, p. 267] and certain others affecting tobacco.

BALD (J. G.). **A method for the selective staining of viruses in infected plant tissues.**—*Phytopathology*, 39, 5, pp. 395–402, 1 diag., 1949.

Spot tests with purified tobacco mosaic virus proved that pre-treatment with iodine–potassium iodide solutions or concentrated acetic acid facilitates the staining of infective material with Giemsa's reagent [*R.A.M.*, 28, p. 438]. Sections of diseased tobacco leaves fixed in Karpechenko's fluid were pre-treated with iodine (4 gm.)—potassium iodide (6 gm.) in 100 c.c. water and stained with Giemsa-orange G in varying proportions, e.g., 4:1. The virus in the form of striate material stained purple. On this basis a fixing and staining schedule was evolved that gave selective staining of tobacco mosaic virus inclusions and other more diffuse material, presumably virus, in the cytoplasm, mainly of epidermal strips from infected plants.

FULTON (R. W.). **Virus concentration in plants acquiring tolerance to Tobacco streak.**—*Phytopathology*, 39, 3, pp. 231–243, 1 graph, 1949.

In tests at the Wisconsin Agricultural Experiment Station to compare the concentration of the tobacco streak virus [*R.A.M.*, 28, p. 85] in necrotic leaves with

that in the symptomless new foliage, infectivity was found to increase with increasing dilution. This reversal of the normal dilution curve was shown to be due to the formation of an inactivator in extracts of diseased or healthy tobacco exposed to air. Since the inactivator developed only after maceration of the tissue and was present in both healthy and diseased leaves, it does not appear to be related to the phenomenon of acquired tolerance.

Rapid inactivation of the virus was prevented by the addition of the reducing agents, cysteine hydrochloride, glutathione, sodium thioglycocollate, potassium cyanide, sodium sulphite (all at 0·01 M), and iron filings (40 mg. per ml.), to the inoculum at the time of grinding the tissue. Untreated inoculum lost 75 to 99 per cent. of its infectivity within 20 minutes. When infected tissue for assay was ground in the presence of a reducing agent, the virus concentration was as high in tolerant as in necrotic leaves of both Wisconsin Havana 38 and Xanthia, or higher. The concentration of tobacco ring spot virus in infected Havana 38 was about the same in tolerant and necrotic leaves, whereas in Xanthia it was higher in the latter than in the former [cf. ibid., 15, p. 752].

Single lesion isolations of the tobacco streak virus were made from bean [*Phaseolus vulgaris*] leaves inoculated with material from tolerant tobacco leaves. These strains proved to be as virulent as those from necrotic leaves.

It was concluded from the foregoing data that the production of new symptomless foliage on streak-infected plants is not due to any reduction in the amount or infectivity of the virus present.

Tall (M. G.), Price (W. C.), & Wertman (K.). **Differentiation of Tobacco and Tomato ringspot viruses by cross immunization and complement fixation.**—*Phytopathology*, 39, 4, 288–299, 1949.

Cross-immunity and complement fixation tests were performed at the University of Pittsburgh, Pennsylvania, to elucidate the apparently conflicting results obtained by Price [*R.A.M.*, 15, p. 831] and Chester [ibid., 17, p. 126] in their studies on the identity of the viruses of tobacco ring spot and tomato ring spot. A hitherto undescribed strain of tobacco ring spot virus, designated as the Pennsylvania strain or *Annulus tabaci* H. var. *pennsylvanicum* n. var., was also included in the experiments. It was first detected in flowering tobacco plants at Pennsylvania State College and differs from the type in its somewhat greater infectiousness, more rapid movement, and the production of slightly larger, zonate, necrotic lesions.

Tobacco ring spot and the Pennsylvania strain of this virus elicited the formation of specific complement-fixing antibodies in rabbit serum, and the same result was obtained with the tomato ring spot strain when the virus in diseased plant sap was concentrated at least 25 times by high speed centrifugation.

Dilutions of antiserum of tobacco ring spot virus and the Pennsylvania strain completely fix complement almost to the same dilution end point with either the homologous or heterologous antigen. This denotes that the two viruses have a similar antigenic structure and should be regarded as strains belonging to the same virus group.

On the other hand, the antiserum of the tomato ring spot strain failed to react with either the type or the Pennsylvania strain of tobacco ring spot, and conversely, neither of the two latter reacted with the antigen of the former, suggesting that the tobacco and tomato ring spot viruses are serologically unrelated.

The results of cross-immunity tests corroborated the foregoing experimental work. In the case of tobacco ring spot and its Pennsylvania strain, each virus protected tobacco plants completely against the other. On the contrary, no protection was conferred by tobacco ring spot on plants inoculated with the tomato ring spot strain, or vice versa. It is concluded that the tobacco and tomato ring spot virus groups are also immunologically and serologically distinct.

Kincaid (R. R.). **Three interspecific hybrids of Tobacco.**—*Phytopathology*, 39, 4, pp. 284–287, 2 figs., 1949.

At the North Florida Agricultural Experiment Station hybrids between the cigar-wrapper tobacco variety Rg, used as the pistillate parent, and *Nicotiana debneyi*, *N. repanda*, and *N. plumbaginifolia* were produced, primarily with a view to the development of resistance to downy mildew (*Peronospora tabacina*) [*R.A.M.*, 24, p. 251], black shank (*Phytophthora parasitica* var. *nicotianae*) [ibid., 22, p. 411], and root knot (*Heterodera marioni*).

All three offspring of *N. tabacum* × *N. debneyi* were resistant to black shank, and the F_2 progeny of two of them (one with leaves suitable for wrappers) showed a measure of resistance to downy mildew in the field, apparently associated with the spread of moisture over the leaf surface in a thin, quickly evaporating film.

The F_2 and subsequent generations of *N. tabacum* × *N. repanda* proved highly resistant to black shank, but the leaves would be valueless as wrappers. One out of three seedlings of the *N. tabacum* × *N. plumbaginifolia* cross gave rise to progeny showing resistance to black shank in the F_2 and later generations.

Van Koot (Y.) & Brons (Miss E. C.). **Winning en ontsmetting van Tomatenzaad.** [Production and disinfection of Tomato seed.]—*Meded. Direct. Tuinb.*, 12, 4, pp. 197–206, 2 graphs, 1949. [English summary.]

Tomato seed can be freed from contamination by the spores of *Verticillium dahliae* [*R.A.M.*, 27, p. 204] and *Didymella lycopersici* [ibid., 24, p. 480] by half-an-hour's immersion in water at a temperature of 45° to 50° C. This treatment exerts no adverse effect on the seed and can easily be carried out by growers. Spores of *D. lycopersici* enclosed in pycnidia are more resistant to heat [cf. ibid., 9, p. 70; 26, p. 184], requiring two hours' immersion at 47·5°, which can probably be just tolerated by the seed. Immediately after extracting the seed should be dried in hot air at 42° to 43° for three or four hours.

Busch (L. V.). **Investigations on Phytophthora infestans with respect to Tomato late blight.**—Abs. in *Proc. Canad. phytopath. Soc.*, 16, p. 14, 1949.

Under field conditions a tomato isolate of *Phytophthora infestans* [*R.A.M.*, 26, p. 570] proved to be highly virulent on tops and tubers of Katahdin potatoes. Reinoculation of tomato plants indicated no loss in the virulence of the pathogen. Bonny Best tomatoes inoculated in the greenhouse with isolates from potato tubers obtained from different counties in Ontario showed varying degrees of infection. Of some 120 species and varieties of tomato inoculated under greenhouse conditions with a virulent tomato strain, only *Lycopersicon hirsutum* was highly resistant; three tomato varieties were slightly resistant, while *Solanum dulcamara* [ibid., 28, p. 28] was susceptible.

Bailey (D. L.). **Specialization in parasitism in Cladosporium fulvum Cooke.**—Abs. in *Proc. Canad. phytopath. Soc.*, 16, p. 15, 1949.

Differential reactions of Stirling Castle, Vetomold, V-121, V-473 and the Vineland strain of Red Currant tomato [*Lycopersicon pimpinellifolium*] plants demonstrated the presence of six races of *Cladosporium fulvum* [*R.A.M.*, 27, p. 354] in Ontario, Canada. Surveys during the last ten years have indicated a stable condition of *C. fulvum* races where only susceptible varieties were grown. The introduction of Vetomold, V-121 [loc. cit.], and V-473, however, was followed in each case by the development of a new fungus race, capable of infecting each variety in turn but otherwise similar to and as constant as the race from which it was apparently derived by mutation.

Under greenhouse conditions two strains of Red Currant as well as *L. hirsutum* and *L. hirsutum* var. *glabratum* were immune.

Walker (R. B.). **Molybdenum deficiency in serpentine barren soils.**—*Science*, 108, 2809, pp. 473–475, 1948.

As part of an investigation of the mineral nutrition of certain plants grown on the serpentine barren soils of Lake and Marin Counties, California, tomatoes were grown in pot culture experiments designed to test the effect of variations in the soil calcium level. Marked responses to increased calcium were obtained, but abnormal symptoms persisted, typical of molybdenum deficiency as described by Arnon and Stout (*Plant Physiol.*, 14, p. 599, 1939) and Hewitt and Jones [*R.A.M.*, 27, p. 401]. Yellowing and curling of the leaflets of the first or second pair of true leaves were followed by pronounced mottling, and later by puffing of the chlorotic areas and marked upcurling of the leaflet margins. Finally, the tips of the leaflets and the areas along the margins began to shrivel and later to die. The newly formed leaves, green at first, became mottled and curled during expansion. Chemical analyses showed the molybdenum content of the affected plants to be less than 0·1 p.p.m. on a dry weight basis. Recovery was obtained by three methods, namely, the application to the soil of sodium molybdate at the rate of 0·81 lb. per acre for young plants, or of ammonium heptamolybdate (1 lb. per acre) for older ones; painting the young mottled leaves with a water solution of sodium molybdate containing 100 p.p.m. molybdenum; and leaf infiltration, in which the terminal leaflet of a lower leaf on a severely diseased plant was cut transversely and the cut end dipped into a vial containing sodium molybdate solution (10 p.p.m. molybdenum).

Limited evidence indicates that Romaine lettuce also suffers from molybdenum deficiency [ibid., 28, p. 372], expressed by chlorosis, spindliness, and retarded growth, on the one soil tested.

Pimentel (A. A. L.). **Notas acerca do aparecimento da 'doença da tinta' do Castanheiro nos viveiros dos serviços florestais portugueses.** [Notes on the appearance of the Chestnut 'ink disease' in the nurseries of the Portuguese forest services.]—*Agron. lusit.*, 8, 4, pp. 303–313, 1946. [English summary. Received July, 1949.]

The information in this paper on the morphology, biology, and physiology of *Phytophthora* A and *Phytophthora* B, differing considerably from *P. cambivora*, which are implicated in the etiology of chestnut ink disease in Portugal, has already been noticed from another source [*R.A.M.*, 28, p. 365]. Discussing the phenomenally extensive and rapid spread of the disease in forest nurseries, the writer holds that the motor transport of plants from infected groves is responsible. Sexual spores or chlamydospores in the soil adhering to the roots would readily contaminate the vehicles, which would then serve as a source of reinfection for further consignments of plants. With the constant repetition of this process the pathogens would be widely disseminated to healthy groves in distant parts of the country. In any case, whatever may be the exact manner of propagation of the fungi, man is evidently the principal agent concerned and measures for the preservation of other nurseries should be planned accordingly.

Wilson (E. E.). **The pycnidial stage of the Walnut branch wilt fungus, Exosporina fawcetti.**—*Phytopathology*, 39, 5, pp. 340–346, 2 figs., 1949.

At Davis, California, in December, 1947, pycnidial stromata, 125 to 500 μ in diameter and 150 to 225 μ in height, developed beneath the bark of young Persian walnut (*Juglans regia*) trees inoculated in the previous May with *Exosporina fawcetti*, the branch wilt pathogen [*R.A.M.*, 27, p. 465]. Isolates from the continuous, hyaline to slightly yellow, elongate, guttulate pycnospores, 11·9 to 16 by 3·2 to 6·5 (mean 14·6 by 5·3) μ, borne on slender, flexuous sporophores, 10 to 15

by 3 to 4 μ, gave rise to a toruloid conidial (arthrospore) stage resembling *E. fawcetti* in morphology, temperature relations, and pathogenicity to walnut, peach, and apricot trees. The Californian fungus appears to be closely allied to *Hendersonula toruloidea*, described by Nattrass in 1933 [ibid., 13, p. 382] as producing both a toruloid and pycnidial stage on apples, peaches, and apricots in Egypt. Studies of type specimens of *H. toruloidea* confirmed the opinion already formed as to the relationship between the two organisms, and it is concluded, therefore, that *E. fawcetti* is the conidial stage of *H. toruloidea*.

Under the rules of nomenclature the walnut pathogen should be designated *H. toruloidea*, provided that Nattrass was the first to describe it, but both Fawcett and the author have mentioned the similarity between the toruloid stage of the Californian species and *Torula dimidiata*, briefly described by Penzig from Italy in 1887 [ibid., 27, p. 103]. However, the meagre information supplied by the last-named writer would not appear to justify the substitution of the specific epithet '*dimidiata*' for '*toruloidea*' at the present juncture.

Ciccarone (A.). **Monochaetia unicornis (C. et E.) Sacc., agente patogeno di un grave cancro dei Cipressi.** [*Monochaetia unicornis* (C. & E.) Sacc., pathogenic agent of a serious canker of Cypress.]—Reprinted from *Ann. Sper. agr.*, N.S., 3, 58 pp., 5 figs., 1949. [English summary.]

The author gives a full acount of his studies on the canker disease of *Cupressus macrocarpa* caused by *Monochaetia unicornis* [*R.A.M.*, 28, pp. 246, 444] in Kenya. He describes the external appearance of the cankers, the chief characteristics of the affected tissues of the trees, the morphology of the acervuli and conidia, the cultural characters, and the systematic position of the causal organism. He compares in detail the Kenya fungus and *Coryneum cardinale* causing canker of the same host in California [ibid., 27, p. 455], and gives an emended diagnosis of *M. unicornis*. In hanging-drop cultures conidial germination was reduced by direct sunlight (a lethal effect being produced in one hour) and by low temperatures; at 5° C. it was very slow. Growth in Czapek's solution as modified by MacInnes, was inhibited at pH 8·5, reached an optimum between pH 4·6 and pH 5·93, and tolerated pH 2·77. On potato dextrose agar the optimum growth temperature was between 22·5° and 23°, the maximum 30° to 35°, and the minimum about 5°. A non-pathogenic varient was isolated on several occasions from *Cupressus lusitanica*.

Campbell (W. A.). **Phytophthora cinnamomi associated with the roots of littleleaf-diseased Shortleaf Pine.**—*Plant Dis. Reptr*, 32, 11, p. 472, 1948. [Mimeographed.]

In March, 1948, following an exceptionally wet winter, *Phytophthora cinnamomi* [*R.A.M.*, 28, p. 366] was isolated from the five roots of a shortleaf pine (*Pinus echinata*) affected by little leaf disease [ibid., 27, p. 224], near Athens, Georgia, using Crandall's technique [ibid., 27, p. 327]. In August, 1948, other isolates of the same fungus were obtained from diseased trees near Carnesville and Elberton, Georgia, and Walhalla and Abbeville, South Carolina. Further work is in progress.

Björkman (E.). **Studier över snöskyttesvampens (Phacidium infestans Karst.) biologi samt metoder för snöskyttets bekämpande.** [Studies on the biology of the snow blight fungus (*Phacidium infestans* Karst.) together with methods for snow blight control.]—*Medd. SkogsforskInst., Stockh.*, 37, 2, pp. 43–136, 2 col. pls., 52 figs., 2 diags., 14 graphs., 1949. [English summary on pp. 129–136].

Much of the information presented in this exhaustive, copiously documented study on the biology and control of the pine snow blight fungus (*Phacidium infestans*) has already been noticed from other sources [*R.A.M.*, 5, p. 264; 8, p. 475; 10, p. 1; 13, p. 814; 21, p. 356, *et passim*]. First described from Finland in 1886, the fungus is now known to occur in other northern European countries, in

Asia, and in North America. It was first reported from Sweden in 1896; here, as elsewhere in Europe and Asia, *Pinus sylvestris* is the only host of practical importance, though in America heavy damage has also been recorded on other conifers.

The results of greenhouse and nursery experiments showed that the maximum distance from the focus of infection that the mycelium of *Phacidium infestans* can cover in the ground or on one- to two-year-old pine seedlings in one winter does not exceed 20 to 30 cm. On the other hand, it was able to traverse a distance of 46 cm. during one winter in seed rows between three- to four-year-old plants, probably on account of the better aeration and higher temperature beneath the snow cover between the taller plants.

In a series of inoculation experiments performed by different methods from 1943 to 1946 the maximum damage invariably occurred among plants attacked during the autumn and early winter, the incidence of infection in March or later being negligible. Uninterrupted development of the mycelium throughout the winter was found to be essential for the production of substantial damage by *P. infestans*. The depredations of the pathogen do not extend beyond 1 to 2 dm. below the surface of the snow cover, the extent of the damage being proportional to the depth of the snow.

Temperature is the controlling factor in the development of the snow blight fungus. In a series of experiments with malt agar cultures the optimum for growth was 15° C. [ibid., 27, p. 501]. At 20° the mycelium grows much more slowly than at 10° and it dies after some time at a constant temperature of 25°. Growth is still satisfactory at 5° and even at 0°, and is not entirely arrested at −5°. At 0° and 5° growth is slow at first but later it becomes very rapid, coinciding with the production of a dense aerial mycelium, the colour of which also varies with the temperature, predominantly greyish-white at 0° to 5°, greyish-black at 10°, deep black at 15°, while at 20° it resumes a paler hue, often yellowish-brown, and thickens. Pigmentation and growth rate were shown to depend to some extent on the temperature of previous culture of the mycelium, both being more vigorous where it had been held at 0° and 5° than at a higher temperature, especially 20°. The temperature requirements of the fungus can be modified, temporarily at any rate, by the operation of external factors. Thus, a period of storage at a low temperature is followed by an enhanced degree of resistance to heat.

Temperature readings showed that the risk of snow blight is least in large, open clearings with a low snow temperature caused in the first place by the severe soil frosts usually occurring in such areas, and secondly by a relatively sparse snow cover, which is readily compacted and therefore serves as an efficient conductor. On northern slopes the snow cover often lies unbroken for two months longer than on southern ones, where the recurrent autumn thaws cause deep freezing of the soil. The former therefore provide more favourable conditions for *P. infestans* than the latter.

Next to temperature, moisture is the most important factor in the development of snow blight. High atmospheric humidity in the autumn was shown to be a prerequisite condition for the growth of the surface mycelium, besides exerting a marked stimulus on the ripening of the apothecia. Experiments and field observations further indicated that this factor is decisive for the dissemination of spores in the autumn. Thus, in the spring of 1945, following a very wet autumn, a large number of new infections arose from spores, whereas after the exceptionally dry autumn of 1945 only a few developed in the spring of 1946.

The nutritional and oxygen requirements of *P. infestans* were shown by laboratory experiments to be very modest. Glucose, laevulose, saccharose, maltose, starch, glycerol, and (to a certain extent) cellulose are utilized as sources of carbon, generally somewhat more effectively when nitrogen is supplied in the form of asparagine rather than in that of ammonium nitrate. The fungus also throve on

other sources of nitrogen. The optimum pH of the pathogen lies between 4 and 6, and no growth occurs below 2·5 or above 7.

Periodical outbreaks of snow blight are a special feature in artificial stands with regeneration of uniform height. From a comparatively mild initial attack in the first year the fungus spreads, partly by spore dissemination and also by concentric development from the old infections, its activity generally culminating after three years, when the attack comes to an end from lack of needles at an appropriate height. Experimental evidence showed that seedlings of northern provenance are more resistant to the disease than those of southern origin. This difference in reaction appears to be connected with the higher dry weight and sugar content of the needles in the northern districts.

From a small-scale trial in northern Lapland it was concluded that not more than half the seedlings should succumb, even to severe attacks, before attaining a height beyond the reach of the pathogen. Snow blight control measures should be directed towards the prevention of spore development and the growth of the mycelium in the snow. The silvicultural practices appropriate to these ends are fully discussed and include the adoption of a cutting method resulting in the thinnest snow cover, the planting of spruce on northern slopes and pine on southern, the use of pines of northern origin rather than southern, the planting of single sets, and drill sowing in preference to patch sowing. In a series of nursery spraying experiments the best results were obtained with 3 per cent. lime-sulphur [ibid., 10, p. 2], which should be applied in atomized form to both diseased and healthy plants with a portable pressure apparatus when the first autumn snowfall is imminent.

Numerous other fungi with a life-history resembling that of *P. infestans* have been studied in connexion with snow blight research. They include various parasites, e.g., *Melampsora pinitorqua* [ibid., 25, p. 18], *Dasyscypha fusco-sanguinea* [ibid., 19, p. 54], and *Fusarium* spp., besides fungi attacking spruce seedlings in nurseries. Among the latter are *Herpotrichia juniperina*; an apparently related species but with pycnidia resembling those of *Ascochyta parasitica* [*A. piniperda*: ibid., 12, p. 667; 27, p. 463], which exclude it from *Herpotrichia*, according to Jørstad and Roll-Hansen [ibid., 25, p. 17]; and the so-called spruce snow blight fungus, belonging to a new and as yet undescribed genus.

Atwell (E. A.). **Red-stain and pocket-rot in Jack Pine : their effect on strength and serviceability of the wood.**—*Circ. For. Serv. Can.* 63, 23 pp., 10 figs., 1 graph, 1948.

After recapitulating the earlier results obtained in this study (conducted since 1926) of red stain (*Fomes pini* and 'fungus no. 2') [*R.A.M.*, 13, p. 135; 21, p. 476] in jack pine [*Pinus banksiana*] railway sleepers the author describes tests carried out at the Forest Products Laboratories, Canada, since 1941. Both fungi were still viable in creosoted ties in 1945 but only in a low percentage of cases; decay due to secondary fungi occurred in only 8 of 160 of these ties after 12 to 16 years' service, the greater part being caused by *Lentinus lepideus*. Affected jack pine has ample strength in bending and compression to permit its use for those purposes for which sound jack pine of similar grade has been specified [ibid., 28, p. 316]. If under 10 per cent. firm pocket rot is present, the wood can be utilized for purposes for which somewhat less drastic strength requirements are demanded. The average service life (up to 1943) of the creosoted jack pine sleepers containing firm red stain was 16·3 years compared with 16·7 for sound ones.

Baxter (D. V.). **Some resupinate Polypores from the region of the Great Lakes. xviii.**—*Pap. Mich. Acad. Sci.*, 32 (*1946*), 1, pp. 189–211, 10 pl., 1948.

In this contribution to the present series [cf. *R.A.M.*, 27, p. 167], which includes two new species and two new varieties, the author states that among the many

species of polypores common to Europe and North America the North American specimens appear to show wider variations in growth and structural features than the others. Therefore, cultural studies are becoming increasingly important.

Fomes robustus [var.] *taxodii* n. var. (on *Taxodium distichum* in Georgia) differs mainly in size from *F. robustus* [var.] *tsugina* [ibid., 14, p. 795], which is very common on *Tsuga canadensis* and *T. heterophylla* and much less abundant on western species of *Abies*. *F. robustus* var. *taxodii* does not cover large areas of log surface, and the tubes are commonly in one layer, i.e., the plant is often less than 0·5 cm. thick and never becomes so multilayered as does the species. It is distinguished from *Fuscoporia juniperina* by its orbicular growth and its greater thickness at maturity. The receding type of growth in old specimens of var. *taxodii* is not apparent in *F. juniperina*, the spores of which measure 5 to 6 μ in diameter; setae occur, though not in *Fomes robustus* var. *tsugina*.

Polyporus [*Polystictus*] *abietinus* causes a common sap rot of dead coniferous wood, which appears two or three years after the death of the tree and develops into a pitted white rot. The first evidence of decay is a faint yellowish or tan discoloration accompanied by wood softening. Later, small white areas or pockets appear, which may or may not be filled with whitish fibres.

Polyporus abietinus f. *fuscoviolaceus* n. comb. [cf. ibid., 25, p. 525] has a resupinate fructification, usually with a slightly reflexed, fimbriate margin, but if not resupinate it has small, imbricate, slightly pubescent, white or grey fruiting bodies. The hymenium is purple or violet, mostly in the form of gills, about one or two to a mm. The basidia measure 15 to 24 by 4 to 6·5 μ; the hyaline, cylindrical, or allantoid spores are 6·5 to 8 by 2·5 to 3·5 μ, the cystidia are mostly 18 to 25 by 5 to 7 μ; and the hyphae measure 3 to 7 μ in diameter. The extreme morphological variants of *Polystictus abietinus* are represented chiefly by the porose form in the limited sense of the species, and by forms in which teeth or even lamellae appear. This latter type has been known in Europe as *Irpex fuscoviolaceus* [loc. cit.]. *Polyporus abietinus* f. *thelepharoides* n.f., unlike many collections of resupinate specimens of the species, has a very depressed margin and is readily mistaken for a species of *Poria*.

F. connatus [ibid., 17, p. 213] attacks a number of hardwoods, but is of economic importance only on sugar maple (*Acer saccharum*). Isolations are very difficult to obtain because the soft, watery sporophores, even when young, are contaminated by other fungi and bacteria. The fungus first darkens the pale maple wood, but the rot seldom spreads more than a few feet in either direction from the fruiting body; hence, a cull three feet above the top sporophore is usually sufficient. Sporophores usually form soon after slight decay has occurred, so that rotted trees are soon detected.

Barnett (H. L.) & Lilly (V. G.). **Production of haploid and diploid fruit bodies of Lenzites trabea in culture.**—*Proc. W. Va Acad. Sci.*, 19, 8–1, pp. 34–39, 1949.

Under identical conditions some cultures of *Lenzites trabea* fruited while others did not, which indicates that the differences are of genetic origin. When freely fruiting haplonts were used as parents, fruiting occurred in 11 of the 12 derived diplonts. With non-fruiting haplonts as parents, only four of the 12 resulting diplonts produced fruit bodies. The evidence suggests that the same factors which influence the formation of haploid fruit bodies by haplonts also exert a similar effect on the production of diploid fruit bodies by diplonts.

McKeen (C. D.). **Soil treatment with arasan in the control of certain seedling diseases of vegetables.**—Abs. in *Proc. Canad. phytopath. Soc.*, 16, pp. 15–16, 1949.

The results of preliminary tests demonstrated that soil treatment with arasan reduced the incidence of onion smut (*Urocystis cepulae*) [*R.A.M.*, 26, p. 404] to less than 1 per cent., while 47 per cent. of the untreated seedlings were infected.

Arasan soil treatment was also very effective in controlling, especially in the post-emergence phase, damping-off (*Pythium ultimum* and *Rhizoctonia* [*Corticium*] *solani*) [ibid., 27, p. 344] in [chilli] pepper, tomato, and spinach seedlings, particularly when combined with seed treatment [ibid., 26, p. 139].

Bosch (E.). **Untersuchungen über die Biologie und Bekämpfung der Vermehrungspilze Moniliopsis aderholdi und Rhizoctonia solani.** [Studies on the biology and control of the propagation fungi *Moniliopsis aderholdi* and *Rhizoctonia solani*.]—*Annu. agric. Suisse*, 49, 10–11, pp. 791–825, 6 figs., 1 diag., 8 graphs, 1948. [French summary.]

A method is described for the inoculation of the soil with pure cultures of the blackleg or damping-off fungi, *Moniliopsis aderholdi* and *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, 17, p. 183; 27, p. 101], which are responsible for heavy annual losses among vegetable and ornamental seedlings in Switzerland. The organisms are grown on sterilized soil in Erlenmeyer flasks and the inoculum thus obtained distributed in the ground in such a way as to ensure the maximum degree of contamination.

No differences were observed between different soils (one- and four-year-old composts and a medium-heavy, sandy clay) as regards the prevalence of damping-off, which depends primarily on environmental conditions, such as soil and air temperatures and humidity, soil pH, and planting density. *M. aderholdi* can cause maximum losses at relatively low temperatures (14° to 15° C.), whereas the virulence of the *C. solani* isolate used in these experiments increased from 20° to well above 30° [cf. ibid., 22, p. 175]. The growth rate of *C. solani* is nearly twice as fast as that of *M. aderholdi*, the average daily increments of the two species in clay pans containing cauliflower seedlings being 9 to 13 and 5 to 10 mm., respectively, close planting (3 as against 6 cm. apart) tending to accelerate the movement of the pathogens. In one test, for instance, the average daily growth rates of *M. aderholdi* over a 36-day period for the 3 and 6 cm. spacings were 9·3 and 5·6 mm., respectively. During the first fortnight of a test on seedlings planted 6 cm. apart *C. solani* grew at the rate of 6·8 mm. per diem, and during the latter half of the month at 13 mm., suggesting the possibility of enhanced aggressiveness of the fungus with its spread from one plant to the next, as observed by other workers, according to Braun [ibid., 9, p. 739].

In experiments to determine the influence of the two pathogens on the germinability of fresh and one-year-old seed of *Brassicae* (white cabbage, Brussels sprouts, and kohlrabi) in sterile and non-sterile soil, the following percentages were obtained: controls 95 to 100 (fresh seed) and 70 to 75 per cent. (one-year-old), and heavily infested with *M. aderholdi* and *C. solani* 15 to 40 per cent. (fresh) and 3 per cent. (one-year-old).

Brussels sprouts, red cabbage, and white cabbage were shown to be much more susceptible to infection by both damping-off fungi than cauliflower, kohlrabi, and Savoy cabbage. *M. aderholdi* causes heavy losses from the very onset of infection, whereas the effects of *C. solani*, except on the most susceptible hosts, are more gradual. In a test including other vegetables and flowering plants, tomatoes and beans [*Phaseolus vulgaris*] were not attacked by either fungus, but spinach, lettuce, *Digitalis gloxiniaeflora*, *Primula malacoides*, *Tagetes signata*, and *Calendula officinalis* were all more or less susceptible.

Soil sterilization by means of steam or dry heat at 98° is by far the most effective method of controlling the damping-off fungi. A measure of antagonism was shown by experiments to prevail between the soil saprophytes, *Penicillium expansum* and *Trichoderma viride*, and the damping-off pathogens [cf. ibid., 42, p. 495], but the results were not such as to encourage hopes of its practical application. In the laboratory experiments which were conducted parallel with the soil investigations,

the optimum pH for both organisms was found to lie between 5·5 and 7: neither grew at 3, but upwards of 3·6 they developed well up to beyond 7, when a decline set in. Glucose, cellulose, filter paper, and pectin were utilized as sources of carbon, while the nitrogen requirements of *M. aderholdi* were supplied by asparagine, potassium nitrate, and urea, the first-named promoting the most abundant growth. The minimum temperature for the growth of both fungi was 4°, the optimum for *M. aderholdi* 23° and for *C. solani* 26°, and the maximum for the former 34°, whereas the mycelial weights of the latter still reached 50 per cent. of the optimum at this temperature.

Miller (W. A.). **Molds on vegetables in Indianapolis retail markets.**—*Bot. Stud. Butler Univ.*, 9, 1–11, pp. 88–92, 1949.

From 57 specimens of vegetables collected in retail markets in North Indianapolis [*R.A.M.*, 20, p. 485] during the period from 1st March to 15th May, 1948, seventeen genera of fungi were identified, the most common contaminants being (in order found) *Macrosporium*, *Rhizopus*, *Aspergillus*, and *Periconia*. The incidence of *Penicillium* and *Rhizopus* was much lower than previously recorded from other sources [loc. cit.]. More than two genera were isolated from tomato, onion, green bean [*Phaseolus* sp.], and turnip.

Voronkevicz (I. V.). Выживаемость возбудителя слизистого вактериоза Капусты **Erwinia aroideae** (**Towns.**) **Holland** в почве. [The longevity of the agent of a bacterial soft rot of Cabbage, *Erwinia aroideae* (Towns.) Holland, in soil.]—Микробиология [*Microbiology*], 17, 1, pp. 91–95, 1948.

Experiments demonstrated that *Erwinia aroideae* [*R.A.M.*, 27, p. 113] isolated from infected cabbage persisted in unsterilized soil for only three to ten days (at the optimum temperature), while in sterilized soil it remained viable up to nine months. At 31° to 38° [C.] the pathogen lived in soil for only 24 hours, whereas at the temperature of melting snow it was alive after 42 days.

In absorbent loams the bacteria perished after one hour; in soil taken from a public road they were viable after seven days. The greater the numbers of the bacterium, the longer they persisted in the soil. The common soil saprophytes had no effect on the growth and pathogenicity of *E. aroideae*.

Dunne (T. C.) & Jones (L. T.). **Molybdenum for the prevention of 'whiptail' in Cauliflowers.**—*J. Dep. Agric. W. Aust.*, Ser. 2, 25, 4, pp. 412–418, 5 figs., 1948.

'Whiptail' of cauliflowers, due to molybdenum deficiency [*R.A.M.*, 28, p. 369] has been known in Western Australia for many years, occurring on both acid and alkaline soils. Occasionally market gardens near Perth have been especially severely affected. In field experiments in 1948 in an area where the disorder was widespread (90 to 100 per cent. affected plants), applications of commercial sodium molybdate (2 to 16 lb. per acre) applied with ammonium sulphate eliminated whiptail. Sodium molybdate, containing about 45 per cent. of the salt, at 2 lb. per acre is recommended.

Hewitt (E. J.), Jones (E. W.), & Williams (A. H.). **Relation of molybdenum and manganese to the free amino-acid content of the Cauliflower.**—*Nature, Lond.*, 163, 4148, pp. 681–682, 1949.

Cauliflower plants of the variety Majestic were grown in sand culture at the Long Ashton Research Station, Bristol, with three levels each of molybdenum (nil, 0·015, and 9·5 p.p.m.) and manganese (0·0055, 0·55, and 55 p.p.m.); the presence of amino acids in tissue extracts was followed by paper chromatography.

The deficiency of both elements, but especially that of manganese, induced an abnormal nitrate accumulation. Molybdenum deficiency resulted in a marked

reduction in the concentration of most amino acids, while a few were hardly affected. The effects of the two elements on the free amino acid content of the leaves were found to be interdependent. Generally a decrease in the molybdenum level resulted in a reduction in the amino acid concentration, while a similar change of manganese level had a reverse effect. Change in molybdenum level caused the greatest effect under conditions of manganese deficiency and change in manganese level produced the most marked effect at high levels of molybdenum.

This evidence is consistent with the hypothesis that molybdenum and manganese catalyse separate reactions, both of which affect the concentration of amino acids as intermediate metabolites in nitrogen metabolism. It also suggests that whereas molybdenum controls one or more reactions leading from nitrate to amino acid production, manganese may function later when the amino acids are further metabolized.

CHAMBERLAIN (E. E.). **Varietal resistance of Swedes to Turnip-mosaic.**—*N.Z.J. Sci. Tech.*, A, 29, 6, pp. 274–276, 1 fig., 1948 (issued 1949).

Field and glasshouse trials have confirmed previous observations as to the differences between swede varieties in their reaction to turnip mosaic virus in New Zealand [*R.A.M.*, 16, p. 359]. In the 1936–7 field experiments Vilmorin proved to be the most resistant, with 17 per cent. average infection compared with 99·5 in Crimson King and Bangholm (Herning), 97·5 in Superlative, 96 in Magnum Bonum, 95 in New White Fleshed, 93·5 in Imperial No. 2 and Masterpiece No. 10, 92·5 in Wilhemsburger (Garton's) and Imperial No. 1, 91 in Sharpe's A 1, and 72·5 in Benefactor and Wilhelmsburger (N.Z. Selection 1), while Sensation also showed moderate resistance (37·5). In glasshouse tests initiated on 16th July, 1945, using *Brevicoryne brassicae* as the aphid vector of the virus, N.Z. Sensation and Dryland were highly resistant (40 and 42 per cent. infection, respectively, on 11th October), as compared with N.Z. Superlative and N.Z. Grandmaster (100 per cent. each). On the two former, moreover, the relatively mild symptoms were slow to develop.

WATSON (M. A.), HULL (R.), & HARTSUIJKER (K.). **Yellowing disease of 'Family 41' Sugar Beet.**—*Nature, Lond.*, 163, 4154, p. 910, 1949.

Referring to recent studies by Clinch *et al.* on a yellowing of sugar beets (family 41) presumed to be seed-transmissible [*R.A.M.*, 28, p. 264] which they appear to identify with beet yellows virus, the authors point out that this identification is based solely on symptomatology, particularly on the accumulation of carbohydrates in the yellowed parts of the leaves. This, however, is not specific to virus yellows or even to virus diseases. The symptoms in family 41 somewhat resemble those of beet yellows, but in the field many plants which do not inherit the disease but become affected later on show important distinguishing features. The chlorotic areas are pale, and the outlines finely indented with sharply defined lobes and scattered chlorotic spots. The yellowing of beet yellows is brighter and the outlines of the chlorotic areas are not sharply defined unless bounded by veins. When the disease from family 41 is introduced into other varieties the symptoms are weak and ephemeral. The authors' experiments failed to confirm that the cause of the yellowing in family 41 is transmitted to other sugar beet varieties by *Myzus persicae* as readily as mild strains of beet yellows. In no case did they secure over 10 per cent. infection and on many occasions there appeared to be no transmission at all. Sap from plants infected with the authors' mild strains of beet yellows virus is precipitated by antiserum prepared against the severe strains, whereas sap from yellowed plants of family 41 is not.

There is no reason to consider that beet yellows is transmitted in the seed of any commercial variety, nor is there any evidence yet that the cause of the yellowing in family 41 is seed-transmitted in commercial varieties or even in family 41,

because it is not known whether the parent plants were infected with beet yellows or any other virus.

Schneider (F.). **Observations on Sugar Beet varieties, 1947.**—*Zucker*, 1, 2, pp. 3–8, 1948. [German. Abs. in *Sugar*, 44, 6, p. 62, 1949.]

Field experiments are reported involving comparisons among the four principal breeding lines of the Rabbethge-Giesecke firm of beet-breeders in Germany, one of which, CR, is resistant to *Cercospora* [*beticola*: *R.A.M.*, 27, p. 212]. This variety showed the lowest ratio of roots to tops (1·44:1) in contrast to E (2·29:1), the energy of the former being mainly directed to leaf, and that of the latter to root production.

Rich (S.). **Some relations between Phaseolus virus 2 and its associated crystalline inclusions.**—*Phytopathology*, 39, 3, pp. 221–224, 1949.

In Blue Lake broad beans from Grand Island, Oregon, newly infected with *Phaseolus* virus 2 [bean yellow mosaic virus], crystalline inclusions [*R.A.M.*, 27, p. 272] were produced just before the appearance of the first external symptoms, i.e., vein-clearing of the youngest leaflets, about nine days after inoculation. The inclusions were demonstrated in parts of the plants showing no symptoms of the disease. Moreover, infective quantities of virus may be obtained from portions of plants devoid of either external symptoms or crystalline inclusions. The latter occurred only in plant parts harbouring infective quantities of virus. The roots neither showed symptoms nor contained crystalline inclusions, and inoculum from these organs failed to induce infection in healthy plants.

Reid (W. D.) & Brien (R. M.). **Control of anthracnose of Dwarf Beans.**—*N.Z.J. Sci. Tech.*, A, 29, 6, pp. 304–306, 1948 (issued 1949).

In further experiments on dwarf bean [*Phaseolus vulgaris*] anthracnose (*Colletotrichum lindemuthianum*) control at the Department of Scientific and Industrial Research, Wellington, New Zealand [*R.A.M.*, 25, p. 199], Bordeaux mixture (6–8–100) and cuprox (5–100) were applied two, three, or four times. Both sprays reduced the incidence of pod infection from 44·76 to between 2·08 and 6·65 per cent., the differences between the two materials and the number of treatments not being significant. All the treatments likewise reduced plant infection, but in this case the results from two applications of Bordeaux were considerably inferior to those obtained with three or four. The average green pod yields from the sprayed and untreated plots were 44·7 and 29·4 oz., respectively.

Frazier (W. A.), Hendrix (J. W.), & Kikuta (K.). **Breeding rust resistant Pole Green Beans for Hawaii.**—*Proc. Amer. Soc. hort. Sci.*, 51, pp. 468–470, 1948.

The most promising high-yielding line of pole green beans [*Phaseolus vulgaris*] resistant to rust (*Uromyces appendiculatus*) developed in Hawaii is the selection 494 [*R.A.M.*, 26, p. 535], a progeny of the cross Bountiful × Lualualei. Its rust readings have not exceeded class 2 (trace). Lines from selection '573' (Pencil Pod Black Wax × Lualualei) × (Bountiful × Lualualei) have also shown promise. The 1946 tests indicated that so far the rust resistance of 494 in commercial crops has been satisfactory throughout the Islands and if it is maintained a named variety may be released in 1948 or 1949.

Kalton (R. R.), Weber (C. R.), & Eldredge (J. C.). **The effect of injury simulating hail damage to Soybeans.**—*Res. Bull. Ia agric. Exp. Sta.* 359, pp. 736–796, 24 figs., 4 graphs, 1949.

In studies carried out at Iowa Experiment Station from 1943 to 1946, damage simulating light, medium, and heavy hail injury was inflicted (by clipping and

beating) on soy-beans in different stages of development. Yields were consistently most reduced when the damage was inflicted as seed development began in the lower pods, the average decreases at this stage being 27, 50, and 77 per cent. for the three degrees of injury, respectively. Yields were reduced least when the plants injured were 6 to 12 in. tall, with two to five trifoliate leaves unrolled. Injuries before and during blooming delayed maturity approximately three days for medium, and eight for heavy, damage. All degrees of damage after the 'green bean' stage hastened maturity by several days, plant height being reduced most when injury was inflicted during blooming, when heavy damage decreased height by about 40 per cent. Medium and heavy damage during seed development lowered its quality and conspicuously reduced its size. Experiments on the effect of reduction of plant height and removal of leaves are also reported.

Chamberlain (E. E.) & Baylis (G. T. S.). **Onion yellow-dwarf. Successful eradication.**—*N.Z.J. Sci. Tech.*, A, 29, 6, pp. 300–301, 1948 (issued 1949).

Since the writers' detection of the onion yellow dwarf virus on onions at Marshland, near Christchurch, and Blenheim, New Zealand, in the season of 1938–9 [*R.A.M.*, 19, p. 511], the disease has appeared at Nelson (1941) and Hastings (1947) and has been found occurring naturally on shallots. By the enforcement of control measures [loc. cit.] the virus has been eradicated from the Marshland onion-growing district. Evidence was obtained that it overwinters mainly on seed onion crops and volunteer plants.

Chamberlain (E. E.). **Occurrence of Lettuce-mosaic in New Zealand.**—*N.Z.J. Sci. Tech.*, A, 29, 6, pp. 296–299, 3 figs., 1948 (issued 1949).

The sap-transmissible, seed-borne virus responsible for lettuce mosaic in three widely separated localities of New Zealand, namely, Christchurch, the Hutt Valley, and Auckland [*R.A.M.*, 27, p. 116], appears to be identical with the lettuce mosaic virus [ibid., 18, p. 649] (*Lactuca* virus 1). Symptoms of the disease in New Zealand include vein-clearing, mottling, and distortion of the leaves, sometimes accompanied by necrotic spotting, dwarfing of the plants, and defective hearting. An incidence of 10 per cent. has been observed in a number of crops. The affected varieties were mostly of the Imperial and Neapolitan types. Transmission of the disease was effected by sap inoculation, using a carborundum abrasive, 23 out of 52 plants inoculated becoming infected, whereas all the controls remained healthy. In tests with seed from diseased plants 3 plants out of 170 developed mosaic.

Sempio (C.). **Sulla devirulentazione della Septoria apii (Briosi e Cav.) Chester in coltura. (Nota preventiva.)** [On loss of pathogenicity by *Septoria apii* (Briosi & Cav.) Chester in culture. (Preliminary note).]—Reprinted from *Riv. Biol.*, 35, 2 pp., 1942. [Received June, 1949.]

Inoculations of celery plants in pots carried out in 1941 with cultures of *Septoria apii* made in 1937 and transferred every two or three months afterwards gave negative results though other celery plants inoculated with spores taken directly from affected leaves or with a one-month-old culture developed infection.

Miller (J. J.). **Further notes on the maintenance of fungus cultures in soil.**—Abs. in *Proc. Canad. phytopath. Soc.*, 16, p. 17, 1949.

Certain cultures of the muskmelon *Fusarium* [*F. bulbigenum* var. *niveum*] maintained their viability, pathogenicity, and cultural characteristics after five years in test tubes containing sterilized soil [*R.A.M.*, 26, p. 309]; they were as pathogenic as recent isolates.

Rahn (E. M.) & Heuberger (J. W.). **The soluble solids content of Cantaloupes as affected by the use of certain fungicides in 1947.**—*Proc. Amer. Soc. hort. Sci.*, 51, pp. 442–444, 1 graph, 1948.

The disease ratings on 11th August, 1947, of cantaloupe melons naturally infected with downy mildew [*Pseudoperonospora cubensis*: *R.A.M.*, 27, p. 313] at the Delaware Agricultural Experiment Station and treated with Bordeaux mixture (6–3–100), copper compound A spray ($3\frac{1}{2}$–100), 10 per cent. copper compound A dust, zerlate spray (2–100), 8 per cent. zerlate dust, parzate spray (2–100), and 8 per cent. parzate dust were 2·5, 3·8, 5·3, 3·5, 4, 2·8, and 5·3, respectively, as compared with 10 for the untreated. The yields (70 per cent. of which were above average in soluble solid content) were 12·9, 13, 15·1, 14·3, 15·9, 14·1 and 14·9 tons per acre, respectively, with 12·6 for the untreated, all of which were below average in soluble solid content.

Barnes (W. C.). **The performance of Palmetto, a new downy mildew-resistant Cucumber variety.**—*Proc. Amer. Soc. hort. Sci.*, 51, pp. 437–441, 2 figs., 1948.

Palmetto, a late cucumber variety developed from crosses between Puerto Rico 40 and Cubit, combines a high degree of resistance to downy mildew [*Pseudoperonospora cubensis*: *R.A.M.*, 26, p. 147] with good commercial qualities. In 1946 its resistance was decidedly superior to that of the commercial varieties, except Burgee Hybrid. In 1947 in a severe epidemic its yield greatly surpassed that of susceptible varieties. In northern trials, however, the results were less satisfactory, as it was found to be susceptible to cucumber mosaic [ibid., 27, p. 109].

Cantaloupe mosaic investigations in the Imperial Valley.—*Plant Dis. Reptr, Suppl.* 180, 15 pp., 4 figs., 1949. [Mimeographed.]

These reports present the results of preliminary investigations into cantaloupe mosaic disease [*R.A.M.*, 22, p. 510; cf. ibid., 27, p. 271] in the Imperial Valley, California, undertaken by the University of California, and the United States Department of Agriculture in co-operation with the local Cantaloupe Pest Control Committee. The disease has caused severe losses locally during the past three years, and threatens to become of major importance in other areas in the vicinity.

J. T. Middleton (pp. 2–3) states that the disease affects most cultivated melon varieties, as well as some other cultivated cucurbits. It may be caused by any one of the strains of cucumber [mosaic] virus [ibid., 28, p. 207], the squash mosaic virus [ibid., 26, p. 478] apparently predominating. The most conspicuous symptoms are light and dark green mottling of the leaves, usually followed by leaf reduction, fruit mottling, and the failure of most melon varieties to set fruit or to mature them normally. The virus occurs in *Cucurbita foetidissima* and *C. palmata*, both native to the Colorado Desert, while squash is believed to be the prime source for the cantaloupe disease. The virus may be spread mechanically or by the seeds of certain plants, and is generally distributed by insect vectors, including *Diabrotica undecimpunctata*, *Acalymma trivittata*, *Aphis gossypii*, *Macrosiphum pisi*, and *Myzus persicae*. In the absence of a satisfactory resistant variety, fair yields may be expected if proper cultural practices are maintained.

Transmission studies by J. E. Swift (pp. 4–5) showed that *M. persicae* and *A. gossypii*, both of which are present in the Imperial Valley, can transmit the virus. The former was by far the most common species found and brought about the greatest number of transmissions. These resulted only with aphids collected from or fed upon infected squash or melons, or with aphids collected in flight. No transmissions occurred when fewer than 15 aphids were used for an inoculation.

R. C. Dickson (pp. 7–8) states that the increased severity of the disease in recent years appears to be related to increase in the spring aphid population, *M. persicae* being particularly important.

G. W. Bohn (pp. 10–13) discusses the problems involved in breeding muskmelons for resistance.

T. W. Whitaker (pp. 14–15) discusses future work on control from the entomological, the horticultural, and plant breeding aspects.

Weimer (J. L.). **Red stem canker of Cowpea, caused by Phytophthora cactorum.**—*J. agric. Res.*, 78, 3–4, pp. 65–75, 4 figs., 1949.

During 1944 a new disease was found causing injury and death to several plants in a field of cowpeas at Experiment, Georgia. The disease reappeared in 1945 in another field but mainly in low, poorly drained areas. Although the disease is not believed to be generally destructive, it is potentially capable of causing considerable damage. It is characterized by long, reddish lesions or cankers, which may occur anywhere on the stem or petioles, and may extend from the base to the tip of the affected plant. At first the infected tissue looks watersoaked but soon becomes maroon or diamine-brown. The centres of old lesions are frequently paler than the margins; often they are nearly brick- or Prussian red, although the centre of a single lesion may vary considerably in colour. The red colour is in the walls of the affected cells and in their densely granular contents. When the tissue dries out the lesions may split longitudinally. Infected stems of young plants may be girdled and the plants killed. Sometimes the apical bud is killed. Usually the lesions appear first a short distance above the soil surface. However, when infection does take place beneath the soil surface the fungus grows up the stem and produces a narrow lesion which becomes broader as it continues above the soil.

Phytophthora cactorum [*R.A.M.*, 28, p. 20] was isolated from diseased tissue and proved to be pathogenic in several inoculation experiments, typical symptoms being produced on young plants three or four days after inoculation. In limited greenhouse tests the varieties Alalong, Speckled Crowder, and Purple Hull appeared to be somewhat resistant. The antheridia of the fungus were commonly paragynous but were sometimes amphigynous.

Experiments showed that infection can take place below ground although under the conditions of the experiments it took place more readily above ground. The fungus can penetrate the cortical cell walls, especially in young tissue, when the hyphae become very constricted. This is the first record of this fungus on cowpea, although it has been reported on several other legumes [ibid., 28, p .18].

Riollano (A.), Adsuar (J.), & Rodríguez (A.). **Breeding Peppers resistant to a Puerto Rican type of mosaic.**—*Proc. Amer. Soc. hort. Sci.*, 51, pp. 415–416, 1948.

In breeding experiments in Puerto Rico for a marketable variety of [chilli] pepper (*Capsicum* spp.) resistant to mosaic [*R.A.M.*, 21, p. 401; cf. 26, p. 535], the standard California Wonder was crossed with a resistant native hot pepper and with a resistant Mexican hot pepper known as Cuaresmeño. Resistance and pungency were found to be inherited as a single genetic factor. Lines 6, 13, 19, 21, 43, and 48 of the latter cross were further selected for their superior commercial qualities and line 19, which produces uniform fruit accepted for the local market, has been released to the Seed Farms Division for increase and distribution in the Island.

Cooper (W. E.). **Top necrosis, a virus disease of Guar.**—*Phytopathology*, 39, 5, pp. 347–358, 2 figs., 1949.

Guar (*Cyamopsis psoraloides*), a native of India, is becoming commercially important in the United States (chiefly California and Arizona) as a source of mucilaginous material from the seed. On 7th July, 1944, an experimental planting at the Oklahoma Agricultural and Mechanical College was observed to be naturally

infected by a hitherto undescribed virus which is included in F. Weiss's list of viruses of leguminous vegetable and forage crops [*R.A.M.*, 24, p. 259] under the name of 'top necrosis'. The incidence of infection increased in the field from less than 0·1 to over 90 per cent. in 2½ months, with an estimated loss of yield of at least 75 per cent. The initial foliar symptoms were yellowing and stunting, with occasional veinclearing or a faint oak leaf pattern, and still more rarely a light chlorotic mottling. Careful inspection revealed a stipple of minute, chlorotic depressions on the leaflets, which later became necrotic. Skewness or rugosity often resulted from unequal interference with growth throughout the leaflet. Many of the older leaves turned bronze, with marked intervenal chlorosis. By 18th August some of the more severely affected plants were bearing dark brown or black lesions on the upper parts of the stems and on the petioles, and as the season advanced general necrosis of the stem and growing point ensued, accompanied by extensive abscission of the younger foliage until finally the stems were left bare but for a few chlorotic lower leaves.

The virus was transmissible through the sap to bean (*Phaseolus vulgaris*), Lima bean (*P. lunatus*), soy-bean, cowpea, green mung bean (*P. aureus*), tobacco, *Nicotiana glutinosa*, husk tomato (*Physalis pubescens*), *Petunia hybrida*, *Datura stramonium*, garden pea, and sesame. Systemic infection developed in 42 bean varieties, five of which also showed local lesions and veinal necrosis, while six presented the latter symptoms alone. On six cowpea varieties the virus induced local lesions from which necrosis spread progressively, becoming lethal in five of them.

The top necrosis virus succumbed to ten minutes' exposure at approximately 68° C. Its dilution end point was 1 in 1,000 and it was inactivated in air-dried tissue. Macerated diseased tissue retained a proportion of its infectivity for two months under refrigeration at 5° or frozen, but was non-infective after four months' storage.

Comparative measurements of the pollen grains developed in tobacco plants completely infected by the guar virus and tobacco ring spot [ibid., 12, p. 472] virus showed reductions in size and uniformity. Apparently only a very small percentage of seed (0·2 per cent. of 2,200 seedlings) from infected *C. psoraloides* plants transmitted the top necrosis virus.

There are many similarities between the typical strain of tobacco ring spot virus [ibid., 19, p. 229] and that of top necrosis on *C. psoraloides*, but certain differences do exist between them. For instance, 37 out of 48 bean varieties failed to react to the guar virus with the production of the local lesions typical of tobacco ring spot. The top necrosis virus from *C. psoraloides* did not infect *Zinnia elegans*, and the symptoms it induced on tobacco were milder than those of the typical strain of ring spot virus. The latter, moreover, was responsible for different symptoms on *C. psoraloides*. These divergences are regarded as sufficient to justify the classification of the guar top necrosis virus as a new and distinct variety of the tobacco ring spot virus under the name of *Annulus tabaci* Holmes var. *cyamopsidis*.

Burrows (S.). **An aerobic medium for fungus growth studies.**—*Nature, Lond.*, 164, 4157, p. 30, 1949.

An aerobic medium for mushroom-growing [*R.A.M.*, 27, p. 61] which allows growth measurements of mycelium to be made may be prepared as follows. Cellulose film trimmings 'PT' (British Cellophane Company) are boiled with a 0·5 per cent. solution of carbide black *E* (Clayton Aniline Company) for one to two hours, until a good dye results. The dye liquor is squeezed out, the clippings washed twice with tap water, soaked in 0·5 *N* hydrochloric acid for one hour, washed again with tap water until the pH rises to about 4, and then with distilled water until sulphate and chloride have been removed. Drying is done at 50° to 70° C., followed immediately by grinding to pass the desired mesh screen. For general work a 1 mm.

screen may be used. The material (100 ml.) is mixed with 100 ml. nutrient solution and packed lightly into 5 by $\frac{3}{4}$ in. test tubes.

Preliminary experiments with mycelium of *Psalliota campestris* using 4 per cent. malt nutrient solution gave excellent agreement in growth rate between replicates when the tubes were inoculated with a $\frac{1}{8}$ in. layer of the cellulose medium in which the fungus had previously been grown from pure culture. The initial linear growth rate is independent of the density of the medium (which varies according to the screen used) within the range 0·7 to 1·7 gm. of moist medium per cm. tube-length.

Burkholder (P. R.) & Nickell (L. G.). **Atypical growth of plants. I. Cultivation of virus tumours of Rumex on nutrient agar.**—*Bot. Gaz.*, 110, 3, pp. 426–437, 1 fig., 1 diag., 3 graphs, 1949.

In experiments at the Osborn Botanical Laboratory, Yale University, wound tumour tissue from *Rumex acetosa* caused by the virus *Aureogenus magnivena* [clover big vein virus: *R.A.M.*, 28, p. 377] grew best in nutrient media containing relatively high concentrations of nitrate and phosphate, 2 to 3 per cent. sucrose, 1 per cent. agar, and with a pH about 5·2. The tumours thus cultivated consist of small parenchymatous nodules containing meristematic zones and some differentiated elements, loosely held together to form a disorganized mass which was never observed to differentiate normal plant organs. Enlarged veins and tumefaction of the roots occurred when a tumour was grafted on to leaves of healthy *Rumex* plants. This virus-infected tumour tissue, showing rapid growth and having apparent stability in a simple basal medium, provides valuable experimental material for further study of problems in the fields of virology and growth and development.

Chamberlain (E. E.) & Matthews (R. E. F.). **A virus disease of Docks in New Zealand.**—*N.Z. J. Sci. Tech.*, A, 29, 6, pp. 286–291, 2 figs., 1948 (issued 1949).

A mosaic disease of docks (*Rumex obtusifolius*, *R. pulcher*, and *R. crispus*) is prevalent in the environs of Auckland and throughout the Manawatu district of New Zealand, commonly causing 50 per cent. infection, while an incidence of 90 per cent. has been observed on some properties. In 1941 infected docks were often found in association with rhubarb plants showing a similar foliar mottling [cf. *R.A.M.*, 27, p. 116], and investigations were therefore made to determine whether a single virus might be responsible for both diseases. However, the available (unpublished) evidence points to the implication of different pathogenic agencies in the two hosts.

Clearing of the smaller veins is the first symptom, which sometimes becomes more pronounced and persists, especially on *R. pulcher*, producing a network mosaic pattern. More often, however, mottling becomes general in mature foliage, forming an irregular mosaic of pale and deep green areas. Infection was transmitted from diseased to healthy plants by leaf-rubbing and the aphids *Myzus persicae* and *Macrosiphum solanifolii*.

The longevity of the virus *in vitro* was variable, usually not exceeding eight hours but more than 48 in one test. The dilution end point was reached at 1 in 50, and the virus was inactivated by ten minutes' exposure to a temperature between 55° and 60° C.

The symptoms of the New Zealand dock mosaic virus closely resemble those described on the same host in England [ibid., 10, p. 199]. The English virus, however, is more persistent *in vitro* than its New Zealand counterpart, and its thermal death point is higher, while the symptoms of the English disease, but not of the New Zealand, are masked at 75°. Thus, the viruses in the two countries are apparently not identical.

Report on the Fourth Commonwealth Mycological Conference, 1948.—87 pp., Commonwealth Mycological Institute, Kew, Surrey, 1948. 7*s.* 6*d.* net.

The papers read at this Conference and the minutes of the scientific discussions are contained in Appendix II (pp. 19–83) of this Report. Administrative measures against plant disease were considered with reference to legislation particularly in South Africa, Kenya, Tanganyika, Uganda, and West Africa. In the discussion on seed certification against seed-borne diseases W. L. Gordon spoke of the importance of seed as a means of disease transmission, reviewed the pathogens involved, and discussed stages in the process and the factors responsible for observed variation in the amount of seed infection. A. E. Muskett described three, simple, accurate, rapid techniques used in the examination of true seed for seed-borne parasitic fungi [*R.A.M.*, 28, p. 185]. W. C. Moore dealt with some possibilities of seed certification in the British Isles, and C. E. Foister described the work of the three sections of the Station of the Department of Agriculture for Scotland, showing the liaison between them, with special reference to seed-borne diseases.

In the discussion on the control of virus diseases N. F. Robertson (West African Cacao Research Institute) gave an account of the recent work on swollen shoot [ibid., 28, p. 276] carried out by himself and his colleagues, [J.] Paine dealing with the history and present situation of control. R. E. D. Baker gave an account of the Trinidad cacao virus [ibid., 28, p. 162, and below, p. 514], and G. H. Berkeley (Canada) outlined the work in progress in the Dominion Plant Pathological Laboratories on virus diseases of stone fruits in Canada [cf. ibid., 28, p. 178] and described the various symptoms. In the past eight years 13 new virus diseases of stone fruits have been discovered in Ontario and British Columbia. [T. E. T.] Bond (Sheffield University) dealt with the prevalence of tea phloem necrosis [ibid., 27, p. 339] in Ceylon, its symptoms and control by the systematic removal of non-productive bushes and their replacement by the best available 'high *jat* seedlings'. J. C. F. Hopkins (Southern Rhodesia) described the means by which tomato spotted wilt virus had been controlled in Southern Rhodesia and its recurrence prevented.

Opening the discussion on the control of virus diseases (certification of vegetatively reproduced crops) [J. E.] Van Der Plank (South Africa) classified the climates which restrict the spread of potato viruses by *Myzus persicae*. [P. H.] Gregory (Rothamsted) dealt with the spread of potato virus diseases [ibid., 28, p. 301] in relation to 'seed' certification and described an ecological study of viruses and vectors in the English lowland potato-growing areas. [R. V.] Harris (East Malling) dealt with research on the virus diseases of soft fruit and hops in relation to the certification of planting stocks for health and productivity [ibid., 28, p. 340].

In the discussion on the diagnosis of nutritional disorders [W. A.] Roach reviewed the chief methods used for diagnosing mineral deficiencies and gave the results of some recent field experiments, while [D. J. D.] Nicholas (Long Ashton) described chemical tissue-tests for determining the mineral status of plants, in particular a field-sampling technique developed at Long Ashton [ibid., 28, p. 356].

[D.] Snow (Reading University) introduced the subject of losses due to fungi in stored foodstuffs. The Food and Agricultural Organization estimate that in comparison with a loss of 5 per cent. of the world's cereals, pulses, and oil-seeds caused by insect damage and 4 per cent. by rodents, 1 per cent. loss is due to moulds. Results of experiments were given, which have enabled the safe levels of humidity for foods stored in bulk to be determined [ibid., 28, p. 347]. L. E. Campbell (British Food Manufacturing Industries Research Association) contributed a paper on the losses due to fungi in stored cocoa, and C. F. Sharman (Imperial Tobacco Company) one on the significance of mould growth in the tobacco industry.

B. B. Mundkur gave a brief résumé of early contributions to the taxonomy of fungi in India, and [E. W.] Mason outlined the organization of the I.M.I. Her-

barium and the means whereby an herbarium can be of great assistance to the taxonomist. H. A. DADE dealt with the C.M.I. culture collection, and S. P. WILTSHIRE with the use of microfilm in systematic mycology.

Speaking on the certification of fungicides [J. T.] MARTIN (Harpenden) indicated the objectives, methods, and progress of the scheme adopted by the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland for the approval in Great Britain of proprietary fungicides and insecticides. I. L. CONNERS described the working of the registration scheme in Canada, and G. H. CUNNINGHAM that in New Zealand.

In the discussion on the use of fungicides in the control of tropical plant diseases, B. B. MUNDKUR outlined the present status of spraying in India, and G. WATTS PADWICK (Imperial Chemical Industries, Ltd.) reviewed at some length the economic difficulties of using fungicides in the tropics and the possibility of reducing them. I. L. CONNERS, in opening the discussion on the development of new fungicides, gave a survey of the ones in current use and some results obtained with them in Canada. R. W. MARSH (Long Ashton) referred to the results obtained with new fungicidal sprays for fruit in Great Britain [ibid., 27, p. 370].

In the discussion on recent developments in pest and disease control machinery [H. G. H.] KEARNS (Long Ashton) pleaded for a more critical attitude to the application of spray materials. He reviewed critically the progress made in spraying equipment since 1939. [D. L.] GUNN (Anti-Locust Research Centre) described the methods of applying insecticides and fungicides from the air.

J. G. DAVIES (Australia) introduced the discussion on the biological control of insects and weeds and read a statement on behalf of C. J. MAGEE about plant pathogens as potential agents in weed control. For the discussion on forest pathology K. D. BAGCHEE (India) outlined the relevant problems in India and M. WILSON and [W. R.] DAY those of Great Britain.

Among the resolutions adopted by the Conference the following may be mentioned. The proposal for an African Phytosanitary Convention was supported and working suggestions made. Subject to the provision of adequate funds and staff, the Conference supported the recommendations of the Brussels Conference that the Commonwealth Mycological Institute should be recognized as the centre of information on the distribution of plant diseases. Recommendations were made for a possible Phytosanitary Convention for south-east Asia similar to that proposed for Africa; for the appointment of at least one mycologist or plant pathologist to every official Seed Testing Station in the Commonwealth; and for expansion of research on fungal wastage in foodstuffs and other stored products. Finally, the Conference unanimously adopted the report of the Technical Committee set up to examine the work and organization of the Institute.

Appendix I (pp. 13–18) contains a review by S. P. WILTSHIRE of the work carried out at the Commonwealth Mycological Institute from 1934 to 1948, and Appendix III (pp. 84–87) contains S. F. ASHBY's review of the work of the Institute from 1935 to 1939.

Thirty-ninth Annual Report of the John Innes Horticultural Institution, 1948.—33 pp., 1 pl., 2 maps, 1949.

On pp. 8–9 of this report it is stated that in the course of breeding work with raspberries, initiated in 1943 and carried out by D. LEWIS and P. R. DAY, the variety Lloyd George, infected with [mosaic] virus [*R.A.M.*, 28, p. 340] at the outset, gave a good crop in 1946 which was maintained in later years, thus indicating a certain recovery from the ravages of virus diseases. Norfolk Giant remained free from virus and outyielded the virus-infected hybrid seedlings. Further breeding trials are in progress to combine virus resistance with high yield and good fruit quality.

M. B. Crane reports that the experiments at Merton and trials in the Midlands on resistance to tomato leaf mould (*Cladosporium fulvum*) [ibid., 26, p. 371] were continued in collaboration with P. R. Day and H. Fairbank (National Agricultural Advisory Service). Several selections have remained quite free from leaf mould, while adjacent susceptible selections were practically defoliated.

Picard (M.). **L'année phytopathologique 1947–48 (1er Octobre, 1947–30 Septembre, 1948).** [The phytopathological year 1947–48 (1st October, 1947–30th September, 1948)].—*Rev. Mycol.*, 13, 3, *Suppl.* pp. 36–45, 1948.

Brief, interesting notes, arranged under host families, are given on the incidence and severity of diseases of cultivated plants, particularly in relation to the weather, observed during the period under review in the course of selection work at Verrières-le-Buisson, Seine-et-Oise, France. Among those specially severe were: *Cladosporium paeoniae* on paeony, *Alternaria cheiranthi* on wallflower, *Puccinia arenariae* on sweet william [*Dianthus barbatus*], *Pseudopeziza* [*Pyrenopeziza*] *medicaginis* on lucerne, *Septoria lupini* on lupin (*Lupinus polyphyllus*), *S. cucurbitacearum* on cucumber, *Heterosporium variabile* on spinach, and *Marssonina* [*Rhynchosporium*] *secalis* on winter barley.

Neergaard (P.). **13. Årsberetning fra J. E. Ohlsens Enkes plantepatologiske Laboratorium 1 August 1947–31 Juli 1948.** [Thirteenth annual report from the J. E. Ohlsen phytopathological laboratory. 1st August, 1947 to 31st July, 1948.]—19 pp., 1949. [English and Esperanto summaries.]

During the period under review [cf. *R.A.M.*, 28, p. 159], 4,908 samples of various horticultural seeds were tested. Bean (*Phaseolus*) [*vulgaris*] contaminants included *Colletotrichum lindemuthianum* and *Ascochyta hortensis* (Sacc. & Malbr.) Jørst. (*A. boltshauseri* Sacc.) [ibid., 27, p. 456] in 22 and 3 lots, respectively, out of 166. *Alternaria brassicicola* was present in many lots of crucifer seeds, including cauliflower (64 out of 74) and white cabbage (32 out of 47). *Stemphylium radicinum* occurred in 46 out of 127 lots of carrot seed. Six out of 14 lots of curled and seven out of 15 of root parsley (*Petroselinum crispum* and its var. *radicosum*) were infected by *Septoria petroselini*, while *S. apii* was isolated from 17 out of 29 lots of celery. Out of 149 lots of peas 89 were invaded by *Ascochyta pisi*. The practical significance of seed transmission of this fungus was investigated in a field experiment covering four years (1941, 1943, 1944, and 1947), when samples of two lots, one heavily infected and the other healthy, were sown side by side, while further samples of the healthy lot were sown at a minimum distance of 25 m. from the diseased. No infection developed in the healthy sown at a distance, whereas the infected seed yielded 13 healthy out of the total of 29 plots; of the remainder, ten were very slightly, four slightly, and two moderately infected. Transmission from the diseased to the adjacent healthy plots occurred in only two out of 16.

Pleospora calvescens was detected in all five lots of opium poppy (*Papaver somniferum*) [ibid., 27, pp. 124, 155] and *P. paeoniflorum* as well as in one out of two of *P. glaucum* and 9 out of 11 of *P. rhoeas*. Two lots of cucumber seed harboured *Phyllosticta cucurbitacearum* [ibid., 10, p. 501], which has apparently not hitherto been recognized as seed-borne.

New records include *Alternaria zinniae* [ibid., 28, p. 160] on seeds (in the germinator) of *Impatiens sultani* and *I. holstii* imported from Italy, and of the latter also from Holland. Both species are new hosts for the fungus. Curled parsley seed was infected by a species of *Ascochyta* with spherical to lentil-shaped pycnidia, 85 to 180 μ in diameter (mean of ten measurements 134 μ), and cylindrical, rarely slightly ellipsoid, uniseptate, hyaline pycnospores, 7 to 12 by 2·5 to 4 μ (mean of 25, 9·2 by 3·3 μ). Five lots of root parsley seeds imported from Hungary contained

perithecia of mildew (*Erysiphe umbelliferarum*) [ibid., 17, p. 770]: the fungus has not previously been reported either from Denmark or the country of origin.

Treatment of seed with liquid air at a temperature range between –183° and –191° C. for 15 or 60 minutes did not have any effect on the incidence of *Stemphylium radicinum*, *Alternaria tenuis* auct. [ibid., 25, p. 579], or *A. brassicicola*, or on the seed of carrot or white cabbage, whereas the germinability of parsley was considerably impaired.

Dyer (R. A.). **Botanical surveys and control of plant diseases.**—*Fmg S. Afr.*, 24, 275, pp. 119–121, 1949.

The following items occur in the botany and plant pathology section of the Annual Report of the Department of Agriculture, South Africa, for the year ended 31st August, 1948 [cf. *R.A.M.*, 27, p. 351]. A new bacterial wilt of maize (*Xanthomonas vasculorum*) was found in the Western Transvaal; the strain appears to be avirulent towards sugar-cane. *Pseudomonas atrofaciens* [ibid., 25, p. 337], causing basal glume rot of wheat, was recorded for the first time in South Africa, in the Alexandria District of the Eastern Cape. A survey of the races of *Puccinia graminis* causing stem [black] rust of wheat was begun, but only no. 34 was found in the Transvaal [cf. ibid., 26, pp. 293, 385, 539; 27, p. 312]. Severe infection of groundnuts by kromnek [tomato spotted wilt: ibid., 26, p. 174; 27, p. 351] occurred in commercial plantings at the Loskop, Vaalhartz, and Riet River Settlements. Cabbage ring spot virus [ibid., 27, p. 352], common on cabbage and cauliflower round Pretoria, was found to cause disease in a wide range of ornamentals, including stocks [*Matthiola incana*], Iceland poppy [*Papaver nudicaule*], Shirley poppy [*P.* sp.], opium poppy [*P. somniferum*], and *Anchusa capensis*. On Shirley poppy and opium poppy the disease is usually fatal. The virus was also found in endive. Potato kromnek [tomato spotted wilt virus: ibid., 27, p. 380] was very troublesome at Riet River and in the Eastern Cape. Encouraging results were obtained with potato varieties resistant to blight [*Phytophthora infestans*], which, it is hoped, will soon be in commercial production.

Promising results against avocado decline (*P. cinnamomi*) [ibid., 27, p. 483] were given by spraying the trees five times at intervals of two or three days with a solution of 4 oz. urea or 13 oz. sodium nitrate per gal., and applying superphosphate and manure to the soil.

Of 316,000 citrus trees inspected, 29 were found to be infected by psorosis [ibid., 27, pp. 319, 320, 361]. The six nurseries registered under the voluntary scheme for using budwood from approved parent trees [ibid., 26, p. 332] have been periodically inspected, but no psorosis was found.

Vine bacterial blight [*Erwinia vitivora*: ibid., 28, p. 49] was recorded for the first time on three neighbouring farms in the Robertson area. The infected portions have been destroyed.

Extensive infection of potatoes by wart [*Synchytrium endobioticum*: ibid., 27, p. 351] occurred in the market-garden area of the Witwatersrand, where the disease was found on 18 of 280 holdings inspected. It was also found on one farm in the Ermelo District, Transvaal, and on another in the Underberg District, Natal.

The following items of phytopathological interest are given in other parts of the Report: J. S. Marais (p. 142) states that vine dead arm (*Fusicoccum viticolum*) [*Cryptosporella viticola*: ibid., 18, p. 231; 26, p. 95] is assuming alarming proportions in the Stellenbosch area; spraying trials are in progress.

R. I. Nel (p. 149) found that leaf chlorosis in avocado was also due to manganese deficiency; marked improvement in vigour and yield followed soil- and spray-treatments.

Apple crack [ibid., 28, p. 128] is not associated with boron deficiency, but was much reduced by severe pruning of poor trees. The average crop from mosaic

apple trees [ibid., 27, p. 116] was 195 lb. per tree, as against 294 lb. for healthy trees.

Sooty mildew (*Exosporium sultanae*) [ibid., 27, p. 216] of Sultana vines is now widespread in the Robertson district. Spraying at monthly intervals with Bordeaux mixture (beginning 15 weeks before harvesting) gave good control of *Phytomonas* [*Pseudomonas*] *syringae* on avocado [ibid., 26, p. 457].

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, 47, 5, pp. 229–234, 6 figs., 1949.

The symptoms of and methods of controlling *Uncinula necator* and *Plasmopara viticola* [*R.A.M.*, 28, p. 210] on vines, and the tomato spotted wilt virus on dahlia [ibid., 27, p. 222], chrysanthemum [ibid., 27, p. 136], Iceland poppy [*Papaver nudicaule*: ibid., 19, p. 296], and *Zinnia* [*elegans*] in Victoria are described. Apple mosaic [virus: ibid., 27, p. 116] is common in Victorian apple orchards, the disease being most prevalent and variegation most pronounced on the Jonathan variety. So far no adverse effect on tree growth or yield has been observed. As it has been shown that the disease in Victoria can be transmitted to healthy plants by grafting, growers are advised to avoid selecting propagating material from any part, including the roots, of mosaic-infected trees.

Plant diseases.—*Agric. Gaz. N.S.W.*, 60, 4, pp. 193–197, 4 figs., 1949.

By a regulation operative from 1st May, 1949, bananas must not be sold in New South Wales between 1st May and 30th November in any year unless treated with or dipped in a fungicide containing salicylanilide in such a manner as to kill *Nigrospora sphaerica* [*R.A.M.*, 26, p. 74], the causal organism of 'squirter' disease, and unless the package bears the name of the fungicide followed by the word 'treated' or 'dipped'. Control of both squirter and black end (chiefly *N. sphaerica*, *Gloeosporium musarum*, and *Fusarium* spp.) is obtained by dipping for ½ minute in shirlan AG (25 per cent. suspension of salicylanilide: 1 pt. in 30 gals.), sali-cide banana dip (½ lb. in 25 gals.), or shirlan W.S. (sodium salt of salicylanilide: ½ lb. in 30 gals+a wetting agent).

Poor stands in pea crops caused by soil-inhabiting fungi can be remedied by seed treatment with bunticide, cuprox, oxicop, soltosan, or smutol (2 oz. per bush), agrosan or ceresan (1 oz. per bush.), or the non-metallic compound tetroc [ibid., 25, p. 330], which is less harmful than other protectants to nodule-producing bacteria and facilitates the flow of seed through the drill. Large quantities can be treated in a rotating drum.

Leaf spot of *Gerbera* sp. is often conspicuous during late summer and autumn in New South Wales. The disease is usually caused by *Cercospora* sp., though *Septoria gerberae* [ibid., 27, p. 9] has been isolated occasionally. Seed should be taken only from clean plants and all sowings and plantings made in clean soil. As soon as infection appears the plants should be sprayed with Bordeaux mixture 4–4–50 or copper oxychloride (cuprox, oxicop, or soltosan) 1 oz. per 2½ gals. of water. The addition of 1 fl. oz. white spraying oil per gal. improves adhesiveness. Spray applications should be made every two or three weeks to both surfaces of the leaves. With severely affected plants all infected leaves should be removed before spraying.

Breed (R. S.), Murray (E. G. D.), & Hitchens (A. P.). **Bergey's manual of determinative bacteriology.** Sixth edition.—xvi+1529 pp., London, Baillière, Tindall & Cox, 1948. 82*s.* 6*d.*

The present edition of this manual constitutes a complete revision of the volume, including changes in the text and in the outline classification and an increase in the number of bacterial species described from 1,335 in the fifth edition [cf. *R.A.M.*, 19,

p. 203] to 1,630, excluding many inadequate descriptions found in the literature. A source and habitat index is supplied for the benefit of teachers and investigators. The index of genera and species contains many binomials not previously included in the Manual and each is accompanied by a new bibliographical reference in the text.

The genus *Pseudomonas* [ibid., 28, pp. 273, 446] (revised by R. S. Breed, with incorporation of the plant pathogenic species by W. H. Burkholder) includes *P. phaseolicola* (syn. *P. medicaginis* var. *phaseolicola*), *P.* [*X.*] *solanacearum* [ibid., 27, p. 513], and the following new combinations: *P. tonelliana* (syn. *P. savastanoi* var. *nerii*) [ibid., 7, p. 725], *P. cissicola* (*Aplanobacter cissicola*) [ibid., 21, p. 491], *P. passiflorae* (*Phytomonas passiflorae*) [ibid., 18, p. 331], *Pseudomonas fabae* (*Phytomonas fabae*) [ibid., 16, p. 434], and *Pseudomonas colurnae* (*Phytomonas colurnae* [ibid., 17, p. 98]. [A number of new combinations are antedated by those of Săvulescu [ibid., 27, p. 514]: among them may be mentioned *Pseudomonas desaiana* (*Bacillus pyocyaneus saccharum*) [ibid., 15, p. 316], *P. rhizoctonia* (*A. rhizoctonia*) [ibid., 2, p. 446], *P. glycines* var. *japonica* (*Bact. sojae* var. *japonicum*) [ibid., 13, p. 15], *P. stizolobii* (*A. stizolobii*) [ibid., 7, p. 602], *P. castaneae* (*Bact. castaneae*) [ibid., 13, p. 551], *P. maublancii* (*Bact. maublancii*) [ibid., 15, p. 732], *P. helianthi* (*Bact. helianthi*) [ibid., 14, p. 314], *P. panici-miliacei* (*Bact. panici-miliacei* Ikata & Yamauchi in *J. Plant Prot.*, 18, p. 35, 1931), *P. wieringae* (*Bact. wieringae* [*R.A.M.*, 10, p. 120] and *Phytomonas betae* [ibid., 7, p. 421]), *Pseudomonas viridiflava* var. *concentrica* (*Phytomonas viridiflava* var. *concentrica*) [ibid., 12, p. 348], and *Pseudomonas setariae* (*Bact. setariae* [ibid., 14, p. 356]).] Included among the synonyms of *P. tomato* is *Bact.* [*P.*] *punctulans*, and among those of *P. syringae* is *P. vignae*.

The genus *Xanthomonas* (prepared by W. H. Burkholder) [ibid., 28, pp. 56, 273] includes the following new combinations: *X. plantaginis* (*Phytomonas plantaginis*) [ibid., 17, p. 98], *X. acernea* (*Pseudomonas acernea*) [ibid., 17, p. 357], *X. lespedezae* (*Phytomonas lespedezae*) [ibid., 19, 543], and *X. manihotis* (*P. manihotis*) [ibid., 21, p. 325], and others [antedated by those of Săvulescu: ibid., 27, p. 514], including *X. lactucae-scariolae* (*P. lactucae-scariolae*) [ibid., 16, p. 584], *X. rubrisubalbicans* (*P. rubrisubalbicans*) [ibid., 10, p. 129], and *X. zingiberi* (*Pseudomonas zingiberi* Uyeda in *Rep. imp. agric. Exp. Sta. Japan*, 35, p. 114, 1908).

The genus *Erwinia* [*R.A.M.*, 27, p. 513] (completely revised by F. D. Chester and W. H. Burkholder) is characterized as motile rods which normally require organic nitrogen for growth, produce acid from sugars, may or may not liquefy gelatin, and may or may not produce nitrites from nitrates, and is divided into two groups: group I contains pathogens which cause necrosis, galls, or wilts and includes *E. amylovora*, *E. milletiae*, *E. vitivora*, *E. cassavae* (*Bact. cassavae*) [ibid., 17, p. 296], *E. salicis*, and *E. tracheiphila*; the remaining species which normally cause soft rots are put in group II and include the new combinations *E. dissolvens* (*P. dissolvens*) [ibid., 2, p. 158], and *E. rhapontica* (*Phytomonas rhapontica*). Included among the synonyms of *E. carotovora* is *E. phytophthora* [ibid., 28, p. 384].

The genus *Agrobacterium* [ibid., 28, p. 322] (prepared by H. J. Conn) includes *A.* [*Bact.*] *tumefaciens*, *A.* [*Bact.*] *rhizogenes*, *A. rubi*, *A. radiobacter*, and, probably, *A. gypsophilae* and *Bact. pseudotsugae*.

In *Bacterium* (completely rearranged by R. S. Breed and Eleanore H. Clise) the plant pathogens *Bact.* [*X.*] *stewarti*, *Bact. tardicrescens*, and *Bact.* [*X.*] *albilineans* are included.

The rearrangement of the genus *Corynebacterium* [ibid., 28, 381] (by E. G. D. Murray, R. S. Breed, & W. H. Burkholder) leaves the plant pathogens very much as determined by Dowson [ibid., 21, p. 34], except that *C. flaccumfaciens* and *C. poinsettiae* are placed in an appendix to the genus because by the characters used in the keys they would be placed in the Pseudomonadaceae.

The genus *Actinomyces* includes no plant pathogens, these being now placed in *Streptomyces* (revised by S. A. Waksman and A. T. Henrici), as *S. scabies* n. comb. [antedated by that of Skinner: ibid., 26, p. 308] and *S. ipomoea* n. comb. (*A. ipomoea* Person & Martin) [ibid., 20, p. 320 and below, p. 539].

Supplement No. 1 is devoted to the order Rickettsiales and in Supplement No. 2, on the order Virales (The Filterable Viruses), F. O. Holmes presents his arrangement of viruses [ibid., 19, p. 229], subdividing the group into those which infect bacteria, higher plants, and animals, respectively. Among the new plant viruses recognized and given binomials are *Hyoscyamus* mosaic (*Hyoscyamus* virus III), sincamas (*Pachyrhizus erosus*) mosaic, cowpea mosaic, celery calico, radish mosaic, and delphinium ring spot.

Dulbecco (R.). **Reactivation of ultra-violet-inactivated bacteriophage by visible light.**—*Nature, Lond.*, 163, 4155, pp. 949–950, 1949.

The author observed recently that bacteriophages inactivated by ultra-violet irradiation were reactivated upon exposure to visible light (photo-reactivation), but only in the presence of bacterial cells. After exposure to ultra-violet light (2537Å) in a transparent medium, diluted phage samples were plated with a large excess of sensitive cells on nutrient agar. Those incubated in strong light showed a great increase of plaques. The most effective wave-length is the 4047Å line of the mercury arc. The extent of photo-reactivation depends on the ultra-violet light dose, the intensity and composition of and time of exposure to the visible light, and the specificity of the phage.

Baker (R. E. D.) & Dale (W. T.). **Virus diseases of Cacao in Trinidad—II.**—*Trop. Agriculture, Trin.*, 24, 10–12, pp. 127–130, 1 pl., 1 fig., 1 map, 1947. [Received Feb., 1949.]

Further experiments and field studies of the Trinidad virus disease of cacao [see above, p. 508], parts of which have already been noticed [*R.A.M.*, 26, p. 538], have mostly confirmed Posnette's observations [ibid., 23, p. 379].

The mosaic symptoms of strain A do not appear on I.C.S. 6, 53, and 60, and unless young leaves are present the disease cannot be diagnosed on these clones. Trees which have been diseased for several years and have ceased to grow vigorously may exhibit no leaf symptoms, although budding experiments demonstrated that they harbour the active virus. The authors do not consider that crinkling of the leaves and necrosis of the tip [loc. cit.] are due to virus infection.

The leaf symptoms of strain B are slightly more striking than those of strain A and appear chiefly as a continuous vein-clearing which persists after the leaves have hardened. Young leaves of a few varieties exhibit an evanescent reddish vein-banding.

In 1944, when experiments were started to determine the rate of spread of strain A in a ten-year-old I.C.S. plantation, 45 trees were diagnosed as infected on the basis of leaf symptoms; in 1947 there were 242 infected trees representing 43·7 per cent. of the field stand. Of the 312 apparently virus-free trees only 6 per cent. showed other signs of ill-health (three trees were later found to be infected, but without leaf symptoms), while of the 242 virus-infected ones 40 per cent. were in a poor condition. These data indicate that the virus disease causes serious damage to the trees. In 1944 the infected trees yielded consistently better than the healthy ones; in 1945 they were slightly worse; in 1946 again most were slightly lower in yield except I.C.S. 1. In 1947 the average yield from all the infected trees was lower than from healthy ones.

Preliminary tests with insect vectors showed that several species of mealy bug can transmit strain A, the incubation periods ranging from 20 to 117 days.

CICCARONE (A.). **Il problema delle ruggini dei Grani in Etiopia. Tre anni di osservazioni (1938, 1939, 1940).** [The problem of Wheat rusts in Ethiopia. Three years' observations (1938, 1939, 1940).]—Reprinted from *Riv. Agric. subtrop. trop.*, 41, 7–9, 10–12, 42 pp., 1 graph, 1947.

In this account of three years' work on wheat rusts in Abyssinia [cf. *R.A.M.*, 18, p. 95], the author lists the physiologic races of *Puccinia graminis* found there [ibid., 25, p. 495]. As regards the overseasoning of wheat rusts locally, chief importance must be attributed to uredospores on self-sown wheat, on late shoots, and on the straw. The continuous sowing of wheat makes it probable that the rusts are perpetuated by means of the uredospores. In Abyssinia local climatic differences are strongly marked, but in the vicinity of Shoa and Arussi the weather following the heavy rains appears to be of cardinal importance in relation to the outbreak of epidemics. According to the inhabitants, mists are an important factor in increasing infection, especially if they persist during the hot, early hours of the morning, as in low-lying localities. Fluctuations of temperature also favour attack, by temporarily lessening host turgidity and with it cell resistance.

In 1938, as in later years, rusts, especially *P. graminis*, spread eight to ten days after the last heavy rains. Except on the highly susceptible varieties Sabaudia and Littorio the losses sustained were not serious. In 1939, heavy rain fell in October, with resultant epidemics of *P. graminis* and *P. glumarum*, though early sown wheats (mostly Mentana and Quaderna) remained unaffected, as did less early wheats, which showed active immunity, e.g., NB 230 which is resistant only to race K2 of *P. graminis* in Kenya. Late varieties, such as Cappelli and Rossello were attacked by *P. graminis*, and were appreciably damaged by *P. glumarum*. The native wheats suffered rather serious epidemics of *P. glumarum*, *P. graminis*, and *P. rubigo-vera* [*P. triticina*]. In 1940 the first epidemic outbreak of *P. graminis* was noted on 15th August on early-sown wheat on the red soils of Gondi (Aselle). Fresh attacks occurred every eight to twelve days and continued until the first ten days of January on successive crops. Wheat, however, sown in the second half of September and in October (mainly Mentana) in black soil remained unaffected. The evidence obtained in 1940 confirmed that of the previous year, clearly demonstrating the resistance to *P. graminis* of the imported wheats NB 230 and Fanfulla and of the native varieties Siet-acori, Gondiè, Selalè, and Ennat among others.

Among the native wheats the most susceptible to *P. graminis* were, in decreasing order of susceptibility, the Goggiami types of Sciongora, Maitiè, Aiba, Gos Ghimbar, and Siet-acori. Most resistant were Aggia (*Triticum polonicum*), Azaziè, Gondiè, and Amarò. Varieties with pigmented grain (mostly late) also showed appreciable resistance to *P. graminis*, especially Selalè, Ennat, and Tucur Gondiè.

The Siet-acori varieties, were, like Maitiè, Azaziè, and Aggia, more susceptible to *P. glumarum*, to which all the other wheat populations also showed average susceptibility, except Aibo and Gos Ghimbar among the white varieties. The black varieties, mostly grown at high altitudes, showed 5 to 10 per cent. infection by *P. glumarum*. Siet-acori appeared to be more susceptible to *P. triticina* than Gos Ghimbar and Aibo.

Among imported wheats, Mentana in many instances showed over 60 per cent. infection by *P. graminis* in 1939 and 1940 especially in rather early 1939 sowings, where the growth was luxuriant. During three successive years, however, this variety and Riale showed almost complete resistance to *P. glumarum* and *P. triticina*, Riale being rather more resistant to *P. graminis*. Quaderna, resistant to *P. triticina*, showed appreciable susceptibility to *P. glumarum*. Under suitable conditions, Senatore Cappelli and Russello showed fair resistance to *P. graminis* though rather less to *P. glumarum*, while Fanfulla displayed satisfactory resistance to both. NB 230 was resistant to *P. graminis* and moderately resistant to *P.*

glumarum, but markedly susceptible to *Septoria tritici*. Equator was susceptible to *P. graminis* at medium elevations, but it is thought that it might be grown successfully at higher altitudes because of its strong resistance to some races of *P. graminis* and *P. glumarum*.

No evidence has so far been obtained that wheat varieties in general show more resistance locally to *P. glumarum* and *P. triticina* at high elevations than at lower ones. With *P. graminis*, however, it appears that the physiologic races found at high altitudes are different from those present lower down, so that some varieties may, possibly, show increased resistance when sown higher up. Red soils appeared to favour infection by *P. graminis*. In low-lying localities and those with black soils, the sowing period could probably be prolonged with advantage, as here the sowings made in September and October seem the least affected by rusts. Further, sowings should not be made too thickly.

Daly (J. M.). **The influence of nitrogen source on the development of stem rust of Wheat.**—*Phytopathology*, 39, 5, pp. 386–394, 1 fig., 1949.

At temperatures above 80° F. the reactions of susceptible (Marquis), resistant (Mindum), or moderately susceptible (Thatcher) wheat varieties to race 56 of stem [black] rust (*Puccinia graminis tritici*) were little influenced by mineral nutrition [cf. *R.A.M.*, 6, p. 287; 24, p. 180] in tests at the Minnesota Agricultural Experiment Station. Between 65° and 75° Thatcher was completely resistant to the rust when supplied with ammonium nitrogen, and mesothetic (X to X++infection types according to the criteria of Stakman et al. [ibid., 24, p. 273]), but approaching complete susceptibility when furnished with nitrate nitrogen at equivalent levels. The response of Thatcher treated with ammonium nitrate was intermediate, while the resistance of Mindum was maintained irrespective of the nitrogen source.

Resistant and mesothetic leaves of Thatcher and resistant Mindum leaves were analysed for total, protein, amide, amino, and ammonium nitrogen, as well as for total soluble carbohydrates and reducing substances. The results are tabulated and discussed in relation to existing theories of rust resistance in wheat. Although no one fraction could be singled out as responsible for the protoplasmic resistance of wheat to *P. graminis*, it is possible that the balance of metabolites in Thatcher leaves determines the resistance of this variety to race 56, whereas in Mindum another foliar constituent, as yet unknown, is more potent in governing reaction to the pathogen.

The field reactions of the three varieties to race 56 were not affected by the source of nitrogen.

Chester (K. S.) & Wadsworth (D. F.). **Experimental forecast of Wheat leaf rust in Oklahoma for 1949.**—*Plant Dis. Reptr*, 33, 5, 223–226, 1949. [Mimeographed.]

This is the ninth annual forecast of wheat leaf rust [*Puccinia triticina*] in Oklahoma [cf. *R.A.M.*, 27, p. 358]. Each of the first seven forecasts was amply justified in the result not only for Oklahoma but in most cases for much or all of the wheat area to the north. The eighth (for 1948) issued, as usual, on 1st April, considered the prospects as the best for ten years, with rust 'too little and too late' to cause serious damage. The result was precisely as forecast. The 1948 wheat crop was the largest in the history of the United States.

The 1949 season promises normal or average leaf rust development. Some damage may be expected in late-maturing fields and in low, wet situations, but most of the crop is expected to rust late and to suffer no more than the 3 to 5 per cent. damage which represents the average toll of leaf rust in the south-west.

THORPE (H. C.). **A note on the release of some new cereal varieties.**—*E. Afr. agric. J.*, 14, 4, pp. 210–211, 1949.

During 1948 a new biotype, K8, of *Puccinia graminis tritici* was found in Kenya and in the Northern Province of Tanganyika. The cereal varieties released to Kenya farmers for sowing in 1949 are listed [cf. *R.A.M.*, 27, p. 312]. Wheat no. 318 *A J* 4 *A* 1 (a selection from the cross DC by Ceres 721 × 112 E 8 L 5), is fully resistant to all eight biologic races of *P. g. tritici* occurring in the Colony, fairly resistant to leaf rust [*P. triticina*] and resistant up to altitudes of 8,000 ft. to yellow ear rust [*P. glumarum*]. Wheat no. 261 *R* 7 *C* 1 *B* (a selection from the cross 68 E 12 A 1 × Reliance) is fully resistant to seven biologic races of black rust and probably to the eighth. It is fairly resistant to leaf rust and (at altitudes up to 7,000 ft.) to yellow rust. Wheat no. 117 *A* II (pure or regenerated) is a single plant selection from 117 A and has about the same disease reactions as the parent variety. Wheat Rhodesian Sabanero has about the same disease reactions as Sabanero, which, in 1934, was resistant to races K 1 to K 4 of black rust and has since proved resistant to K 5; it has shown, in seedling tests, reactions bordering on susceptibility to K 6 and K 7, and definite susceptibility to K 8.

DICKINSON (S.). **Studies in the physiology of obligate parasitism. II. The behaviour of the germ-tubes of certain rusts in contact with various membranes. III. The growth of rust mycelium out of infected leaves. IV. The formation on membranes of haustoria by rust hyphae and powdery mildew germ-tubes.**—*Ann. Bot., Lond.*, N.S., 13, 50, pp. 219–236, 6 figs.; 51, pp. 337–343, 8 figs.; pp. 345–353, 1 fig., 1949.

In further studies at the School of Agriculture, Cambridge, on obligate parasitism [cf. *R.A.M.*, 28, p. 234] the phenomena exhibited by the germinating uredospores of *Puccinia triticina*, *P. graminis*, and *P. glumarum* [ibid., 26, p. 482] as they enter the living host plant were observed in germ-tubes growing on specially prepared, artificial membranes. In making collodion membranes the required amount of solution was poured on to a level glass sheet of known area and allowed to dry. Circles 1 in. in diameter were then scratched on and the separate membranes floated off on water and mounted on metal rings above distilled water. A few, well separated spores were scattered on the membrane from a fine camel-hair brush. Paraffin wax collodion membranes (0·05: 0·4 per cent. in 9: 91 alcohol-ether) and the same plus a thin layer of cell wall debris from pulverized wheat seedling leaves were also used. Cytological preparations of collodion membrane cultures were made by modification of a method already described [ibid., 6, p. 309]. The initiation of nuclear division and the formation of appressoria, substomatal vesicles, and infection hyphae were shown to be induced by a contact stimulus. The firm adhesion of the basal swelling to the membrane was not due to the presence of a mucilaginous coat at the germ-tube tip. Infection hyphae of *P. triticina* formed on the membranes when transferred to wheat leaf strips produced haustoria in the living mesophyll cells. The substomatal vesicle of *P. triticina* was orange-red, that of *P. graminis* brown-red, and that of *P. glumarum* yellow.

In the third study leaves of young susceptible wheat plants, which were just showing the flecking stage of infection with *P. triticina* and *P. graminis*, were placed in a chamber having a relative humidity of about 98 per cent. A large area of mesophyll tissue was exposed by stripping off the lower epidermis and the leaves were placed with the exposed mesophyll upwards on 3 per cent. gelatin containing 7·5 per cent. sucrose in Van Tieghem drop cells. A plain collodion membrane with distilled water on the upper surface was used instead of a coverslip. Hyphal tufts grew out from the infected tissues. With experience it was found possible to distinguish them with the naked eye. They were shown to be those of

P. graminis and *P. triticina*. Although the type of medium did not affect the appearance of hyphal tufts, the number and length of hyphae in them were influenced by the concentration of sucrose. The failure of the hyphae to grow out of uninjured leaves may be due to lack of sufficient power to break through the epidermis.

In the fourth study hyphae were obtained from a leaf infected with *P. triticina* by laying the freshly stripped mesophyll of a four- to seven-day-old leaf on paraffin wax collodion or paraffin wax gelatin membranes on the surface of 4 per cent. gelatin. Examination of membranes which had been in contact with exposed, infected leaf mesophyll for 48 hours showed clusters of hyphae up to about 200 μ long. After contact they grew along the membrane and formed structures resembling haustoria which adhered to the membrane and finally pierced it. The similarity in method of formation and size between these structures and the haustoria in the host is very close. The germ-tubes from spores of *Erysiphe graminis* formed similar structures.

Simard (T.). **Enquêtes sur la distribution de l'Épine-Vinette commune dans la Province.** [Inquiries into the distribution of common Barberry in the Province.] —*Rep. Quebec Soc. Prot. Pl., 1945–1947*, p. 146, [? 1948].

The common barberry is not widely distributed in Quebec, but thousands of these plants with rust aecidia on the leaves have recently been found in the Frelighsburg—Dunham—Cowansville area. Cereals in the vicinity, however (when examined after several weeks' drought), were free from or only very slightly affected by *Puccinia graminis*, although couch grass [*Agropyron repens*] was heavily infected [cf. *R.A.M.*, 26, p. 195].

Pal (B. P.). **The control of Wheat rusts by breeding.**—*J. Indian bot. Soc.*, 27, 4, pp. 169–185, 1 pl., 1948.

The epidemic of black rust (*Puccinia graminis*) in the winter of 1946–7 [*R.A.M.*, 28, p. 55], which devastated the wheat crop in Central and Peninsular India, drew attention to the need for taking comprehensive and active measures to deal with the menace of wheat rusts, a note on the control of which was published by J. F. Dastur and B. P. Pal on the basis of discussion with Dr. J. N. Mukherjee (*Sci. & Cult.*, 13, pp. 91–98, 1947). The present paper deals with the plant breeding aspect of the wheat rust problem. In the 1946–7 epidemic the varieties New Pusa 52, N.P. 4, N.P. 165, Pb. C. 591, and Niphad 4 showed some degree of resistance.

In the 1946–7 trials of a series of new wheats bred by the author at the Indian Agricultural Research Institute, the new strains N.P. 710, N.P. 715, N.P. 761, and N.P. 775 gave good results. At Simla high resistance to all the physiologic races has been achieved separately for each rust (*P. graminis*, *P. triticina*, and *P. glumarum*) [*R.A.M.*, 27, p. 358] and attempts are now being made to combine resistance to all three by means of a double cross made on a large scale. So far the varieties Klein Exito, Klein 157, Klein Alberti, Pionerka, Novo, Ukrainka, Reiti II, Hybrid 481, Pervenec, Horanka, Arandamy, *Triticum fungicidum*, *T. timococcum*, *T. timopheevi*, and *T. sovieticum* are resistant to all three rusts. In the Central Provinces and Bombay the work has been concerned with resistance to *P. graminis* only, which is usually the dominant rust in that area. During 1947–8 the varieties N.P. 710, N.P. 715, N.P. 671, and N.P. 775 proved promising in the Central and United Provinces, Bombay, Bihar, and Orissa. After discussing the new sources available for breeding for rust resistance the author lists all the varieties reported resistant to the various rusts and summarizes the present situation and the future outlook of this work.

WATERHOUSE (W. L.). **Studies in the inheritance of resistance to rust of Barley. Part II.**—*J. roy. Soc., N.S.W.*, 81, 3, pp. 198–205, 1948.

In further studies of resistance in barley to leaf and stem rusts (*Puccinia anomala* [*P. hordei*] and *P. graminis tritici*, respectively) [*R.A.M.*, 7, p. 314; 26, p. 448] evidence was obtained confirming the action, in the crosses studied, of a single dominant factor for resistance to *P. hordei*. This applied to varieties obtained from widely scattered sources and is in contrast with wheat leaf rust [*P. triticina*] where, according to unpublished data, at least two major genes operate.

Seedling tests with *P. graminis tritici* did not give such clear-cut reactions as are obtained with *P. hordei*, and pustule size was the chief distinguishing feature. The varieties tested are classified into 13 groups according to their reactions to *P. g. tritici* races 34, 43, and 45, as well as to *P. hordei*. Many F_1 tests showed dominance of resistance to *P. g. tritici* race 43 and of susceptibility to races 34 and 45 of this rust. No correlation with resistance to *P. hordei* was found.

Inoculations in the glasshouse and field observations showed the following varieties to be resistant to *Erysiphe graminis hordei* [loc. cit.]: C.I. 2269, C.I. 2215, C.I. 2237, C.I. 2280, C.I. 2218, C.I. 2250, Lion, No. 22, Psaknon, White Hull-less, Bolivia, C. I. 2329, Juliaca, Coast, Portuguese, Goldfoil, Hanna, Bark, Bolivia, Bel. 2071, Duplex, 017, Kwan, and Weider.

LANSADE (M.). **Sur l'efficacité et l'emploi des polychlorobenzènes dans le traitement de la carie du Blé.** [The efficacy and use of some polychlorobenzenes in the treatment of Wheat bunt.]—*Parasitica*, 5, 1, pp. 1–4, 1 graph, 1949.

In experiments carried out at Versailles from 1943 to 1947, Bon Fermier wheat grain was uniformly infected with spores of *Tilletia tritici* [*T. caries*] (400 mg. per kg. seed) and treated with ortho- and paradichloro-benzene, and tri-, tetra-, penta-, and hexachlorobenzene [*R.A.M.*, 27, p. 358; 28, p. 279] either by immersion in various concentrations for 20 minutes or by dusting at the rate of 200 gm. dust per 100 kg. seed. The lots were then sown and the ears examined for bunt at harvest time. Control lots were treated with copper chloride for comparison.

The results showed that hexachlorobenzene was the most active of the benzenes and superior to copper chloride since 5 to 6 per cent. of the pure product gave the same degree of control as a 20 to 22 per cent. copper chloride dust (7·5 to 8 per cent. copper). A 50 per cent. solution of pentachlorobenzene was sufficiently effective, but at lower concentrations its effectiveness decreased rapidly. Nevertheless its presence in small quantities does not diminish the value of hexachlorobenzene. In suspension (wettable powders) the hexachlorobenzene preparations proved completely effective at a concentration of 2:1000. Even in its pure state it did not prove harmful to the seed.

It is concluded that hexachlorobenzene is a particularly valuable fungicide for controlling *T. caries*, being easily applied, inexpensive, and more active than copper products. At present it is in the process of commercial manufacture.

SIMARD (T.) & LUDWIG (R. A.). **Études sur les maladies de l'Orge disseminées par la semence.** [Studies on seed-borne diseases of Barley.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, pp. 79–81, [? 1948].

During 1942 and 1943, barley seed from various parts of Quebec showed about 50 per cent. infection by *Helminthosporium teres* [*R.A.M.*, 26, p. 389], 65 per cent. by *H. sativum* [ibid., 27, p. 511], and by *Fusarium* sp., while *Alternaria tenuis* was commonly present saprophytically. When sown at a high temperature, 20 per cent. of the plants from these seeds, even after disinfection with ceresan, bore basal lesions.

Of 850 affected seeds from ears affected by 'ear blight' in the summer [of 1944], 80 per cent. showed infection by *Fusarium* sp. and 2 per cent. by *H. sativum*. The

species of *Fusarium* most commonly found, according to identifications by Dr. Gordon would appear to be *F. poae* [ibid., 24, p. 143].

Glasshouse inoculations showed that the pathogenicity of *H. sativum* is much greater than that of *Fusarium* sp. Soils inoculated with ten different cultures of the former gave 44 to 78 per cent. blight, as against a very low percentage for *Fusarium* sp. (except three cultures, which gave 14 to 39 per cent. blight). The inoculations also demonstrated that several strains of *H. sativum* exist in nature which differ in pathogenicity. Pathogenicity also varies in any one strain according to the organ attacked. Some barley lines or varieties appear to be more susceptible than others to leaf infection by *H. sativum*.

Control measures recommended include seed treatment with ceresan, crop rotation, and the use of resistant varieties.

Simard (T.). **Résultats des expériences coopératives de 1946 du Comité de protection des céréales sur les maladies des semis d'Avoine et d'Orge.** [The results of co-operative experiments in 1946 by the Committee for cereal protection on diseases of Oat and Barley seedlings.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, pp. 147–148, [? 1948.]

When oat and barley seed carrying various degrees of infection by *Helminthosporium* [*Pyrenophora*] *avenae* and *H. sativum* [see preceding abstract], respectively, was sown in nine different localities in Quebec Province there seemed to be some relation between the state of health of the seed and the amount of infection that developed on the young plants, and also between percentage emergence of oat seedlings and percentage infection of oat seed by *P. avenae*. Seed treatment with ceresan increased emergence of oats by about 6 per cent. and of barley by 8 per cent.; it also increased the proportion of healthy oat plants by about 29 per cent. and of barley by nearly 24 per cent. On the whole, the seed treatment gave better results in the east and north-east where emergence and health of the seedlings were inferior, and was more effective on severely infected than on lightly infected seed.

Lachance (R. O.). **Le charbon nu (Ustilago nuda) et le charbon noir (Ustilago nigra) de l'Orge dans la Province de Québec.** [Loose smut (*Ustilago nuda*) and black smut (*Ustilago nigra*) of Barley in the Provinc eof Quebec.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, p. 43, [? 1948].

In 1943, examination of 147 viable samples of smutted barley [grain] in Quebec showed that 88 (59·9 per cent.) were infected by *Ustilago nuda* [*R.A.M.*, 28, p. 389] and 55 (37·4) by *U. nigra* [ibid., 25, pp. 60, 256; 26, p. 15], while four (2·7) were infected by both. In 1944, of 56 viable samples 42 (75 per cent.) were infected by *U. nuda* and 14 (25) by *U. nigra*.

Leblond (D.). **Relation entre le nombre de spores de maladies portées par les grains de semence et la manifestation de ces maladies dans le champ.** [The relation between the number of disease spores carried by cereal seed and the manifestation of these diseases in the field.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, pp. 141–145, [? 1948].

Examination in 1944 of oat seed collected in Quebec [see above, p. 519] showed that the most numerous spores present were those of *Ustilago avenae* and *U. levis* [*U. kolleri*: *R.A.M.*, 26, pp. 389, 390], which averaged (together) 16,000 per seed. Next (20 per seed) came various species of *Fusarium*, and third (15 per seed) *Helminthosporium* [*Pyrenophora*] *avenae* [loc. cit.]. Some seeds were contaminated with *Septoria avenae* [*Leptosphaeria avenaria*: ibid., 27, p. 257], *Puccinia graminis*, and *P. coronata*. The commonest and most numerous moulds belonged to *Alternaria*, *Aspergillus*, *Cephalothecium*, *Cladosporium*, *Penicillium*, and *Mystrosporium*.

Plants from seed with no spores of *U. avenae* and *U. kolleri* developed 0·7 per cent. average infection (minimum 0, maximum 2 per cent.) in the field, with 0 to 100 spores 3·4 per cent. infection (0 to 21), with 100 to 1,000 spores 5·8 per cent. infection (0 to 18), with 1,000 to 2,000 spores 10 per cent. infection (0·5 to 29), with 2,000 to 5,000 spores 15·7 per cent. infection (0·5 to 43), with 5,000 to 10,000 spores 7·7 per cent. infection (0 to 32·5), with 10,000 to 20,000 spores 16·1 per cent. infection (9 to 32), with 20,000 to 50,000 spores 21·4 per cent. infection (2 to 54), and with 50,000 or more spores 35·1 per cent. infection (19 to 74 per cent.). Similar results were obtained with seed infected by *Pyrenophora avenae* [see above, p. 520], but while in this case there appeared to be a relation between the number of spores carried by the seed and the amount of seedling blight that resulted, there was no relationship between the percentage of blighted seedlings and of leaf stripe on the adult plants.

Down (E. E.). **Two new varieties of Oats for Michigan.**—*Quart. Bull. Mich. agric. Exp. Sta.*, 31, 3, pp. 263–265, 1949.

Two new oat varieties, Kent and Bonham [*R.A.M.*, 28, p. 116] were increased for the first time in 1948 for introduction to Michigan farmers. Selected from a cross between Bond and D 69, both carry resistance to *Helminthosporium victoriae* [loc. cit.] and to rusts [*Puccinia graminis avenae* and *P. coronata*]. Kent should prove a good replacement for Huron, having as high a test weight and a rust resistance which Huron lacks. Bonham is high-yielding and is also resistant to smut [*Ustilago avenae* and *U. kolleri*]. *H. victoriae* was recorded officially in Michigan in 1948 in the southern three tiers of counties, where many fields of Vicland were almost worthless.

Van Hoof (H. A.). **Infection of Sorghum vulgare Pers. by Colletotrichum falcatum Went.**—*Landbouw*, 21, 6, pp. 267–276, 4 figs., 1949. [English summary.]

In February, 1948, during the west monsoon, a severe attack of red rot (*Colletotrichum falcatum*) [*Physalospora tucumanensis*] was observed on the sorghum varieties Malang and No. 245 at Buitenzorg, Java. The rot may extend from the plume to the fourth internode below it, the lower stalk infections arising in the tunnels of boring insects. Diseased stalks frequently break just above the leaf sheath or in the plume. The seed-grain of Malang, ordinarily yellow, was blotched and red-speckled. In tests to determine the relative prevalence of *P. tucumanensis* and other fungi on the seed of five sorghum varieties, the red rot organism was present only on the Malang and Pietersburk white varieties, the incidence of infection after a week in the germinator on germinated and ungerminated lots of the former being 50 and 16, respectively, and on the latter (from two sources) 5 and 9, and 2 and 2, respectively. Seedlings from heavily infected seeds contracted root rot, which was never observed, however, in older plants. The foliar lesions, extending over almost the entire length of the midrib, are mostly some mm. long, with greyish centres and red margins; they do not appear to affect plant growth to any extent. The application of a spore suspension to the leaf sheath resulted in leaf and flower infection, but the stalks could only be inoculated through wounds. During the east monsoon the symptoms were milder but did not disappear. Seed disinfection with mercurials failed to eliminate the pathogen.

The marked susceptibility of Malang and No. 245 to both *P. tucumanensis* and *Helminthosporium turcicum* is of importance in relation to the sorghum-breeding programme at the General Agricultural Research Station: outbreaks of both diseases are particularly liable to occur under humid conditions. [This paper also appears in *Tijdschr. PlZiekt.*, 55, 3, pp. 221–228, 4 figs., 1949.]

Bennett (C. W.) & Costa (A. S.). **Tristeza disease of Citrus.**—*J. agric. Res.*, 78, 8, pp. 207–237, 3 figs., 1949.

In experiments carried out at Campinas, Brazil, on 'tristeza' (root rot) disease of citrus [*R.A.M.*, 28, p. 61] transmission could not be effected by means of juice from affected sweet orange plants. Of 91 sweet orange plants inoculated by establishment on them of *Cuscuta* spp. which had grown on diseased plants, one, inoculated by means of *C. subinclusa* became infected, while another, inoculated by means of *C.* sp. showed symptoms resembling tristeza. The condition was transmitted to ten varieties of sweet orange on sour orange rootstock in field conditions by inserting buds from affected trees, and to sweet orange plants on sour orange rootstock in the greenhouse by the insertion of buds and twigs from diseased trees.

The causal virus was transmitted to small plants under greenhouse conditions by infesting them with *Aphis citricidus* from diseased plants [cf. ibid., 27, p. 564]. Single infective aphids induced only a low percentage transmission, whereas large numbers gave a high percentage. In tests with over 1,400 plants the disease was not transmitted through seeds of sweet or sour orange.

No symptoms known to be caused by tristeza were observed on any citrus variety or citrus relative on its own roots, though certain forms of vein yellowing occasionally seen on isolated twigs of grapefruit and other types of citrus may, possibly, have been due to the disease. The scion-stock combinations that showed injury were sweet orange, Marsh seedless grapefruit, Mexeriqueira tangerine, mandarin, Thornton tangelo (*Citrus paradisi* × *C. reticulata*), and Galician lemon on sour orange rootstock, and probably sweet orange on grapefruit rootstock. The results of inoculations of small plants by *A. citricidus* indicated that the following scion-stock combinations may be susceptible to injury in glasshouse conditions: sweet orange on Viçosa grapefruit and Doce and Melancia shaddock (*Citrus grandis*); and Viçosa grapefruit, Doce shaddock, Cleopatra mandarin (*Citrus reticulata*), Satsumelo 10–V–3, and Sunshine tangelo on sour orange rootstock. When small seedlings were inoculated by means of *A. citricidus* sweet orange appeared to be more susceptible than sour.

The virus was transmitted to small sweet orange plants on sour orange rootstocks from trees of the following scion-stock combinations showing no evidence of disease. Pera sweet orange on Rangpur lime (*Citrus aurantifolia* or possibly *C. reticulata* × *C. aurantifolia*), rough lemon on its own roots, 'cravo' tangerine (*Citrus reticulata*) on its own roots, and an unidentified citrus tree on its own roots.

None of the methods of control so far tried in Brazil have proved satisfactory, and in future it is proposed to make new plantings with trees of scion-stock combinations resistant to injury. The most satisfactory rootstocks so far found are sweet orange, rough lemon, Rangpur lime, and sweet lime.

Malençon (G.). **Le bayoud et la reproduction expérimentale de ses lésions chez le Palmier-Dattier.** [Baïoud and the experimental reproduction of the lesions in the Date Palm.]—*Mém. Soc. Hist. nat. Afr. Nord* (hors sér.), 2, pp. 217–228, 3 figs., 1949.

Experimental inoculations of date palms through wounds of all kinds with the causal organism of baïoud disease (*Fusarium albedinis*) [*R.A.M.*, 26, p. 53; 28, p. 332] having consistently given negative results, the author carried out numerous floral infections (100 in 1946 and over 400 in 1947). Flower shoots were removed from an emerging female inflorescence, placed in water, and the stigmas inoculated with conidial suspensions of different strains of the fungus. After 48 hours, hyphae appeared on some stigmas and 24 hours later most of them were brown, faded, and covered with a white down, while the surfaces of some of the flowers

showed a light brown discoloration. By the fourth or fifth day the flowers had turned completely brown, in many cases exuding a drop of clear, red liquid. They became detached at the least touch. Later still, the shoot turned dark chestnut-brown round the point of insertion of each flower. This discoloration surrounded the shoot, spread upwards and downwards, and quickly reached the other spots formed round neighbouring flowers. By the tenth day, the shoots had turned black along various distances and the flowers had become decomposed. Similar experiments under field conditions gave rise to similar lesions on the flowers. Different strains of the fungus used possessed different degrees of virulence. Conidial fructifications developing on the surface of the dead flowers belong to the same organism that causes the internal lesions, many of the author's inoculations being made with such conidia. This shows that superficial fructifications do, in fact, constitute foci of propagation of the parasite. The proved fact that the flowers afford one means of entry to the fungus explains the infections *per descendum* observed by the author and other workers.

The author's observations as a whole show, however, that in nature the disease seldom starts at the top of the tree, infected flowers being very soon blown off. Young trees grown from seed were found to be infected before flowering. Many cases of spontaneous infection were found at the bases of trees, the fungus spreading upwards; the roots were diseased and gave a *Fusarium* resembling *F. oxysporum* and a species of *Trichoderma* (*T. koningi* sensu lato) [*T. viride*: ibid., 18, p. 761], the latter occurring very regularly. As *F. albedinis* is widely present in the soil of palm-groves it is possible that either alone or in association with some other organism it finds frequent opportunities to enter softened roots or bases, which are always moist, and thence spreads to the rest of the tree. In any case, the initial phase of the disease appears to occur as a rule at soil level or in the soil, other modes of entry being merely accidental. Experimental confirmation of this view is to be sought.

Hekimi (M.). **Pseudomonas malvacearum.**—*J. Plant Prot.*, 2, 7, pp. 161–165, 7 figs., 1949. [Turkish, with English summary.]

Angular leaf spot of cotton caused by *Pseudomonas* [*Xanthomonas*] *malvacearum* [*R.A.M.*, 26, p. 531], which was first observed in Turkey in 1936, was reported from western Anatolia this year but was not serious owing to the dry weather.

Mains (E. B.). **New species of Torrubiella, Hirsutella and Gibellula.**—*Mycologia*, 41, 3, pp. 303–310, 2 figs., 1949.

Descriptive notes and Latin diagnoses of the following entomogenous fungi [cf. *R.A.M.*, 17, p. 240] are given: *Torrubiella pulvinata* n.sp. on arachnids in Hawaii, *T. confragosa* n.sp., on large scale-insects on the Rio Grande do Sul, Brazil, *T. liberiana* n.sp. and *Hirsutella liberiana* n.sp. each on an ant in Liberia, *H. ramosa* n.sp. on fragments of a lepidopterous larva in Nova Scotia, and *Gibellula formicarum* n.sp. on ants in Liberia.

Drechsler (C.). **An Endocochlus having binary helicoid thalli of left-handed rotation.**—*Mycologia*, 41, 3, pp. 229–251, 6 figs., 1949.

A detailed description is given of *Endocochlus binarius* n.sp., destroying *Amoeba papyracea* in decaying oak leaves in North Carolina [cf. *R.A.M.*, 14, p. 360; 15, p. 720].

Moureau (J.). **Cordyceps du Congo belge.** [*Cordyceps* of the Belgian Congo.]—*Mém. Inst. roy. colon. belge*, 7, 5, 58 pp., 5 pl. (3 col.), 1949.

As the result of work begun in 1940 in the Belgian Congo and concluded at the University of Liège, the author describes the macro- and microscopic characteristics

and taxonomy of 24 species of *Cordyceps* found in the Belgian Congo [*R.A.M.*, 28, p. 311]. He suggests that the genus *Cordyceps* sensu lato should comprise three subgenera, viz., *Torrubiella*, *Eucordyceps*, and *Ophiocordyceps*. The new species described are *C.* (*Torrubiella*) *carnata*, *C.* (*Eucordyceps*) *filiformis*, *C.* (*E.*) *truncata*, *C.* (*E.*) *aurea*, *C.* (*E.*) *furcata*, *C.* (*E.*) *rubripunctata*, *C.* (*E.*) *variegata*, *C.* (*E.*) *pseudo-insignis*, *C.* (*E.*) *lutea*, and *C.* (*E.*) *lilacina*. A complete collection of all the species described and the type specimens of the new species are deposited in the Herbarium of the State Botanic Garden, Brussels.

Middelhoek (A.). **Laboulbeniaceae in Nederland III.** [Laboulbeniaceae in the Netherlands III.]—*Ned. kruidk. Arch.*, 56, pp. 249–260, 10 figs., 1949.

This is a critically annotated list of nine species of entomogenous Laboulbeniaceae collected in Holland [cf. *R.A.M.*, 27, p. 71], including six new species and one new genus.

Lachance (R. O.). **Action de divers désinfectants sur la viabilité de Colletotrichum lini dans la graine de Lin.** [The action of various disinfectants on the viability of *Colletotrichum lini* in Flax seed.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, p. 76, [? 1948].

Flax seed with 51 per cent. infection by *Colletotrichum lini* [*C. linicola*: *R.A.M.*, 26, p. 404] was disinfected with ceresan at the rate of 1½ oz. per minot [39 l.] and with arasan and spergon at the rate of 2 oz. per minot. Samples of each treatment and of untreated seeds were taken at intervals, washed in running water, superficially disinfected with calcium hypochlorite, and tested by incubation on agar plates for seven days. The amount of infection by *C. linicola* present in the untreated samples and those treated with arasan and spergon remained unchanged for six months. In seed treated with ceresan infection fell to 12 per cent. on the seventh day, 9 per cent. on the fifteenth, and 5 per cent. one month after treatment, remaining at this figure up to the six months. After 15 months, the samples treated with spergon and arasan each showed 5 per cent. infection, those treated with ceresan 0 per cent., and the untreated 29 per cent.

Jacques (J. É.). **Étude étiologique de la tache hétérosporienne de l'Iris.** [An etiological study of *Heterosporium* spot of Iris.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, p. 42, [? 1948].

The hyphae [of *Heterosporium gracile*: *R.A.M.*, 18, p. 31; 22, p. 179; 25, p. 185] penetrate iris leaves by way of the stomata or directly through the cuticle into the cavities of the epidermal cells, whence they pass into the neighbouring cells and intercellularly into the chlorenchyma. In the vascular tissue some spread into the spiral vessels. Spore age, light, and humidity play an important part in the development of infection.

Arnaud (G.) & Bitancourt (A. A.). **The perfect stage of the fungus causing spot anthracnose of Arbutus unedo L.**—*Mycologia*, 41, 3, pp. 320–322, 1 fig., 1949.

A re-examination of the herbarium material of *Arbutus unedo* bearing *Sphaceloma mattirolianum* [*R.A.M.*, 12, p. 661] at the Centre de Recherches Agronomiques, Versailles, showed that the lesions bore several *Elsinoe* ascomata, which are described. The presence on the same lesions of acervuli and sporodochia of *Sphaceloma* and of ascomata of *Elsinoe* indicates that both are part of the life-cycle of the same organism. The ascomata are, therefore, considered to belong to *S. mattirolianum* and the fungus is named *E. mattirolianum* n.sp.

Schander (H.). **Ein Beitrag zur Lösung des Problems der 'Kalkchlorose' bei den Pflanzen. (Eine gegenüberstellende Betrachtung der biochemischen Untersuchungen Iljins und der Müncheberger ernährungsphysiologischen Untersuchungen zur Züchtung einer 'kalkunempfindlichen' gelben Süsslupine.)** [A contribution to the solution of lime-induced chlorosis in plants. (A parallel survey of Iljin's biochemical studies and the Müncheberg nutritional-physiological researches on the development of a 'lime-tolerant' yellow sweet Lupin.)]—*Jb. wiss. Bot.*, 91, 1, pp. 169–185, 1 graph, 1943. [Received June, 1949.]

Some of the information presented in this contribution to the study of juvenile chlorosis of yellow lupins at the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, Mark Brandenburg, Germany, has already been noticed from another source [*R.A.M.*, 24, p. 19]. These nutritional-physiological data are compared with the conclusions reached by Iljin [cf. ibid., 23, p. 374], who approached the problem from a biochemical angle.

Langdon (R. F. N.). **Ergot of Poa annua L.**—*J. Aust. Inst. agric. Sci.*, 15, 1, pp. 39–41, 1949.

During July and August, 1946, *Poa annua* growing in a localized area at Padstow, near Sydney, was heavily infected with ergot, which the author identified as *Claviceps purpurea* [*R.A.M.*, 17, p. 105], the first record on this host in Australia. The disease did not recur during the two following winters. Rye, skinless barley, and wheat (Durum, Ford, Three Seas and Bencubbin), when inoculated with conidia of the pathogen, gave similar, but atypical reactions. The ovaries, which mostly remained small and shrivelled, were invaded by mycelium and often a white, paste-like coating of conidia developed on the outer surfaces. No honeydew was produced. *Lolium rigidum* reacted normally. Inoculations of *P. annua* with the rye strain of *C. purpurea* gave negative results. The evidence indicates that the Australian strain of *C. purpurea* on *P. annua* differs from the European strain.

Petch (C. E.). **Elemental sulphurs in Apple orchards.**—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, pp. 91–95, [? 1948].

The author began to investigate substitutes for lime-sulphur on apple trees in Quebec in 1934 [cf. *R.A.M.*, 18, p. 532], and four years' data showed that although apple scab [*Venturia inaequalis*] was not so well controlled in some years by the materials used, yet the crop on the average was commercially larger, an increase of 20 per cent. being obtained on McIntosh. Growth was maintained in spite of the increased crop and was at least as good as that on the trees treated with lime-sulphur. No additional cost was involved. The elemental sulphur used was bentonite sulphur (kolofog) [ibid., 24, pp. 318, 320; 25, p. 383] and its failure on many occasions to control scab is ascribed to its low sulphur content (33 per cent.).

In 1945 at Rougemont micronized sulphur (3–40) gave much better control of scab than liquid lime-sulphur (1–40), though the province was affected by the worst epidemic of *V. inaequalis* in its history and there were large numbers of severely affected trees only a few feet away. In addition, the foliage on the trees sprayed with micronized sulphur was superior to that on those treated with lime-sulphur.

Staehelin (M.). **Expériences dans la lutte contre la tavelure et l'oïdium du Pommier en 1948.** [Experiments on the control of Apple scab and mildew in 1948.] —*Rev. romande Agric., Vitic., Arboric.*, 5, 3, pp. 23–24, 1949.

During 1948, spraying tests against apple scab [*Venturia inaequalis*] and mildew [*Podosphaera leucotricha*] were carried out in three localities in Switzerland [*R.A.M.*, 28, p. 461].

The results obtained showed that against scab the wettable sulphurs were as

good as or slightly better than lime-sulphur alone, and caused no foliage injury or leaf- and fruit-fall. The trees sprayed with wettable sulphur retained their green foliage until harvest, and branch growth was unaffected by the treatment. The addition of lead arsenate and copper products to the wettable sulphurs did not cause burning, and the efficacy of the wettable sulphurs would probably have been enhanced by the addition of a small quantity of copper oxychloride or carbonate.

The wettable sulphurs used also gave satisfactory control of mildew, though dangerous to employ on varieties susceptible to sulphur injury, i.e., Baron de Berlepsch, Laxton Superb, Melba, Cox's Orange, Jonathan, Calville Blanc, Reinette du Canada, and Belle de Boskoop; the first four should be treated with organic sulphurs at flowering to obviate burning and leaf-fall.

BÜTIKOFER (H.). **Betrachtungen zur Klimaabhängigkeit von Podosphaera leucotricha (Apfelmehltau).** [Considerations of the dependence on climate of *Podosphaera leucotricha* (Apple mildew).]—*Schweiz. Z. Obst- u. Weinb.*, 58, 13, pp. 231–233, 2 graphs, 1949.

The occurrence of apple mildew (*Podosphaera leucotricha*) in Switzerland [see preceding abstract] is promoted, generally speaking, by a mild, warm, relatively dry climate. Individual factors in favour of the disease are a mean April temperature exceeding 11° C., moderate atmospheric humidity (60 to 70 per cent.), and short periods of rainfall. It is, however, a combination of these factors rather than any one of them separately which is decisive in the development of the pathogen.

BERDUCOU (JEANNE). **Recherches sur le mode d'action de certains champignons parasites (Nectria).** [Studies on the mode of action of certain parasitic fungi (*Nectria*).]—*C. R. Acad. Sci., Paris*, 228, 12, pp. 1052–1054, 1949.

The invasion of apple stems by *Nectria galligena* [*R.A.M.*, 19, p. 27 *et passim*] is followed by an intensive proliferation of the cells surrounding the point of entry, whereas *N. cinnabarina* is capable of killing the branches of apple and other trees in the absence of any cicatricial reaction on the part of the host [cf. ibid., 28, p. 39]. In the studies reported it was found that the mycelial mat of *N. galligena* with adhering medium contained relatively large quantities of β-indole acetic acid, which it is thought may have been responsible for the formation of wound tissue induced by the pathogen [cf. ibid., 27, p. 285], whereas *N. cinnabarina* gave a negative reaction, possibly due to the lack or insufficiency of the growth substance.

WADE (G. C.). **'Little leaf' of Apples.**—*Tasm. J. Agric.*, 20, 2, pp. 101–102, 1 fig., 1949.

Symptoms of little leaf [*R.A.M.*, 25, p. 505] occur on apples in many parts of Tasmania, including the New Norfolk, Gravelly Beach, Grove, and Tasman Peninsula districts. They develop on one or two limbs at first, but later the entire tree becomes affected. The tops of affected limbs develop short, narrow leaves borne close together and producing a rosette effect. These leaves are often pale green to yellow in the intervenal parts. Little, if any, terminal shoot growth develops and the top is practically bare except for the rosette of very small leaves. The bark commonly turns reddish-brown; later, an apparently normal shoot grows out lower down the limb, but the leaves, normal at first, become mottled and distorted. The weak growth at the top of affected limbs is frequently attacked by *Polystictus versicolor*, which spreads down the limb and kills it; if it reaches the trunk it kills off the whole tree.

Little leaf has been shown to be due to zinc deficiency in two districts in Tasmania. Control by spraying in late winter with 50 lb. zinc sulphate per 100 gals. water [loc. cit.] is recommended.

Tavernier (J.) & Jacquin (P.). **Assimilation et fixation du bore par le Pommier. Fumure boratée appliquée par pulvérisation.** [Boron assimilation and fixation by Apple trees. Borate fertilizer applied by spraying.]—*C. R. Acad. Agric. Fr.*, 35, 7, pp. 275–279, 1949.

In tests carried out at Rennes in 1947 and 1948 in which apple trees were sprayed with a 0·25 per cent. solution of sodium borate at petal-fall and again a fortnight later, fruit from treated Reinette de Caux, Calville Blanc, Ontario, Jonathan, Reinette du Grand Fay, Calville du Mont Dor, Reinette du Mans, and Reine des Reinettes contained considerably more boron per kg. dry matter than fruit from untreated trees although none of the control trees or fruits showed any sign of boron deficiency. Increased boron was present in all parts of the flowers and fruit, in the seed, and in the leaves.

Vanderwalle (R.). **Une affection des marcottes de Prunier causée par Cylindrocladium scoparium.** [A disease of Plum layers caused by *Cylindrocladium scoparium*.]—*Parasitica*, 5, 1, pp. 5–8, 1 pl., 1949.

Since July, 1945, a new wilt disease of nursery plum layers has been observed in Belgium, notably on the variety Saint-Julien. Black Damas and Brompton are also subject to slight attacks. Infection appears to spread more rapidly along the rows than transversely. From the focus of infection the disease spreads particularly rapidly beside bordering paths, indicating that the pathogen is soil borne and probably spread by agricultural implements. A deep necrotic lesion extended from the soil region several centimetres up the stem. At soil level the external tissues of the stem had collapsed. In some cases the stem was exposed to the wood which appeared unchanged. The area on either side of the necrotic region was thickened by hypertrophy of the cortical tissues. The roots had completely disappeared from the infected area; those situated above the lesion remained alive for a time before eventually succumbing.

Histological examination of the lesions revealed that practically all the tissues were rotted and invaded by mycelium except for the fibrous pericyclic zone and the wood which appeared to be practically intact.

In culture, pieces of diseased tissue yielded a characteristic reddish-brown colony. In the course of several transfers microsclerotia were consistently produced but no conidial stage was observed. Growth on nutrient agar was regular and radiate with numerous microsclerotia forming in concentric rings.

The symptoms were produced in the varieties Saint-Julien and Brompton two months after inoculation and they died the next year. The causal organism was recovered from the lesions produced. No symptoms were produced in inoculated Black Damas under the conditions of the experiment. The causal organism was identified as *Cylindrocladium scoparium* which also occurs on plum in England [*R.A.M.*, 23, pp. 30, 305].

Delmas (H. G.). **Sur un cas d'infection d'un Prunus Marianna réputé résistant.** [On a case of infection of Marianna *Prunus*, reputed to be resistant.]—*Progr. agric. vitic.*, 131, 20, pp. 265–267, 1949.

Root rot of fruit trees is due chiefly to *Armillaria mellea* and *Rosellinia necatrix* [cf. *R.A.M.*, 5, p. 746; 9, p. 116; 24, p. 453]. In 1947 the author obtained from California some apricot trees grafted on Marianna plum 2624, a clone reputedly resistant to root rot. Three of these trees were planted in infested soil at Grande Ferrade, France, and when the buds opened they were cut down to ascertain the reaction of the stock. Only one tree survived to the spring of 1949, when it failed to bud and the roots were found to be infected by *R. necatrix*. Thus the resistance of this stock is apparently not complete.

Diener (T.). **Ein Rostpilz auf Kirschenblättern.** [A rust fungus on Cherry leaves.] —*Schweiz. Z. Obst- u. Weinb.*, 58, 13, pp. 228–230, 1 fig., 1949.

In November, 1948, *Puccinia cerasi* was observed within the precincts of the Wädenswil Experiment Station attacking three young cherry trees. The rust is known to occur in Italy [*R.A.M.*, 15, p. 236], but has very rarely been found north of the Alps, the only other records for Switzerland dating from 1848 (doubtful) and 1877. The pale grey teleutosori may easily be mistaken for young infections of *Cylindrosporium padi* [ibid., 26, p. 157]. The rust is of no practical importance.

Wade (G. C.). **Diseases of Raspberries and Loganberries.**—*Tasm. J. Agric.*, 20, 2, pp. 94–100, 6 figs., 1949.

Notes are given on the symptoms and control of the following diseases of raspberries and loganberries with special reference to Tasmanian conditions: anthracnose (*Elsinoe veneta*) [*R.A.M.*, 25, p. 170; 27, p. 509], cane blight (*Leptosphaeria coniothyrium*) [ibid., 26, p. 159], spur blight (*Didymella applanata*) [ibid., 25, p. 125], yellow leaf rust (*Phragmidium rubi-idaei*) [ibid., 25, p. 566], crown gall (*Bacterium tumefaciens*) [ibid., 19, p. 716; 20, p. 154; 21, p. 29] *Armillaria* [*mellea*] or shoestring rot [ibid., 17, p. 49; 21, p. 29], mosaic [ibid., 27, p. 246; 28, p. 179], waterlogging, and wind scorch.

Of these, anthracnose often causes serious damage, and its effects are even worse on loganberries than on raspberries; under Tasmanian conditions the fungus seldom attacks the leaves. The control measures recommended consist in cutting out all the old infected canes at pruning time and spraying with Bordeaux mixture (6–4–40) at green tip and at half strength when the white of the petals just shows through the blossom buds. In severe cases, a further spray at full strength should be applied immediately after picking.

Mosaic is not present in commercial raspberry plantations in Tasmania, though it has occasionally been found on isolated plants. The Department of Agriculture is endeavouring by quarantine measures to prevent it from becoming established.

Strawberry summer wilt disease causes drastic failure in south Hampshire, with little sign of varietal resistance.—*Fruitgrower*, 108, 2795, p. 108, 1949.

According to the first report on investigations on south Hampshire strawberry problems, based on work carried out at the Botley Experiment Station from 1946 to 1948, a summer wilt of obscure origin is a graver factor in local crop failures than red core [*Phytophthora fragariae*: *R.A.M.*, 28, p. 341 and next abstract], which was suspected to be the cause of the trouble. In this connexion it is significant that one of the varieties sustaining the heaviest damage from the new disease was Auchincruive Climax, which is known to be highly resistant to red core. In experiments originally designed to test varietal reaction to *P. fragariae*, plants of Madame Lefebvre, Perle de Prague, Auchincruive Climax, No. 257, Huxley Giant, Oberschlesien, No. 475, and Cambridge Early were set out in early April in a cold, saturated soil and their strength built up by stopping blossom and runners during the maiden year. The mortality from red core was comparatively low, though some injury was suffered by many plants of certain varieties. However, from mid-July onwards in the second year, all the varieties suddenly collapsed, irrespective of their known susceptibility to *P. fragariae*. Unsatisfactory physical conditions of the soil may be concerned in the failure, since an analysis 16 months later revealed a marked deficiency in humus.

Reid (R. D.). **Breeding Strawberries for disease resistance.**—*J. Minist. Agric.*, 55, 11, pp. 476–482, 1949.

The author reviews the breeding work against strawberry red core (*Phytophthora fragariae*) [see preceding abstract] at Auchincruive, Scotland, since 1933.

There is, probably, no absolute line of demarcation between susceptibility and immunity, but there is a widely varying range of susceptibility. Of the older varieties, Madame Lefebvre is the most susceptible and Oberschlesien and Pillnitz the most resistant. Once a field has become infected, however, no known variety is commercially resistant in the climate and soil conditions prevailing in the west of Scotland. Varieties from all over the world were tested. The first promising line was a selection from what was believed to be the Frith variety, grown under its plot number, 52. Later, the American variety Aberdeen was ascertained to be the most resistant. By combining no. 52 with Aberdeen very encouraging results were obtained.

The proportion of seedlings showing resistance in the first year varies from season to season, according to the weather. The general behaviour of the families in infested soil, however, provides a good indication of the relative merits of different crosses. Families of seedlings from susceptible parents may show 90 to 100 per cent. infection in the first year, though families raised by crossing two highly resistant parents, tested under identical conditions, may develop under 25 per cent. infection. Resistance appears to be a dominant factor. Usually, the most highly resistant varieties prove completely resistant when tested under the most severe conditions for periods up to eight years on a variety of farms, but when released into commerce they may occasionally show infection. The introduction of these varieties, however, has made it possible to grow strawberries again on land where the crop has invariably failed during the last 20 years when ordinary varieties have been planted.

In 1938, selections of the 'Auchincruive' varieties were distributed for extensive trials in Lanarkshire. By 1941, the best stocks were released free of all restriction, not named, but retaining their test numbers, Auchincruive 1, 2, 4, 5, and 6, the most popular being 1, 5, and 6.

The next introduction, in 1945, was LR 19, not specially resistant to red core, and sensitive to virus diseases of the yellow edge type, but some growers have been extremely successful with it in non-infected areas. The most recent introduction is Auchincruive Climax, released in April, 1947. It is retaining its resistance to red core well, but may develop acute symptoms of virus disease and second-year plants may show a chlorosis perhaps due to nutritional factors [cf. preceding abstract].

DANTAS (B.). **A ocorrência da 'cercosporiose' da Bananaia no Brasil, Cercospora musae Zimm.** [The occurrence of Banana 'cercosporiosis' in Brazil, *Cercospora musae* Zimm.]—*Bol. téc. Inst. agron. Norte* 14, 45 pp., 11 pl., 1 map, 1948. [English summary.]

Banana leaf spot (for which the name of 'cercosporiosis' is proposed) has been found in the Amazon Valley of Brazil [*R.A.M.*, 26, p. 333] in both the perfect (*Mycosphaerella musicola*) and imperfect (*Cercospora musae*) states. On the Inojá variety the spots were detected on the margins of the petioles, as well as on the leaf surfaces. The dimensions of the hyaline, mostly curved, cylindrical, 3- to 7-septate conidia, which were produced only after the collapse of the central tissues of the brown spots, were 37 to 81 by 2·5 to 3·5 μ. The perithecia measured 40 to 70 μ, the aparaphysate, oblong to clavate asci 25 to 33 by 7·5 to 11 μ, and the bicellular, hyaline ascospores 13·2 to 18·2 by 3 to 4·2 μ [ibid., 20, p. 413]. The fungus throve on a medium consisting of 10 gm. oats, 5 gm. each of dextrose and peptone, and 20 gm. each of agar and crystallized commercial sugar per l., the addition to which of 1 per cent. meat extract or 5 per cent. young banana leaf extract stabilizes the cultural characters and stimulates the appearance of the conidia (on the 15th day).

The leaf spot occurs on all the edible banana varieties grown in Amazonia. The symptoms caused by three other local pathogens of banana, namely, *Cordana musae*, *Chloridium musae* [ibid., 26, p. 334], and *Helminthosporium torulosum* [ibid., 27, p. 100], are briefly described with their distinguishing features.

The measures proposed for the control of *M. musicola* are the banning of the entire infested area, from which no parts of banana plants, living or dead, should be transported to other districts of Brazil; compulsory 60-day quarantine for fresh stocks imported from any zone known or suspected to be infested; eradication of the pathogen from the infested area by the gradual destruction of the most severely diseased plantings and their renewal with resistant varieties; the use in new plantations, especially in recently cleared areas or those not previously planted with bananas, of the Branca [white], Pacovão, and dwarf (*Musa cavendishii*) varieties, and the absolute exclusion of Peroá; the observance of plant sanitation practices during and after planting; and discontinuance of the use of banana leaves for the wrapping of agricultural products.

Chowdhury (S.). **Some studies in the Rhizopus rot of Jack Fruit.**—*J. Indian bot. Soc.*, 28, 1, pp. 42–50, 6 figs., 1 graph, 1949.

The male inflorescences and young fruits of the jak fruit tree (*Artocarpus integrifolia*), which is grown extensively throughout the hills of Sylhet and Cachar for its fruit, are so badly attacked by *Rhizopus artocarpi* [*R.A.M.*, 27, p. 411] that only 68 to 85 per cent. of the fruit reach maturity each year. The rot usually begins near the stalk end which is covered by the mycelium. The area beneath rots and in a short time the whole fruit mummifies and eventually drops off.

The details of the morphology of the organism are given. The fungus grew well on oat, potato dextrose, malt, and Dox agars. The optimum temperature for the formation of the fructifications was 22° to 27° C.; at 12° and 32° they were entirely absent.

Berry (H.) & Perkin (H. A.). **An investigation into the action of fungicides. Part I. Preparation of suspensions of mould spores, and the effect of clumps on the accuracy of sampling.**—*Quart. J. Pharm.*, 19, 4, pp. 535–544, 2 diags., 1946.

A simple method for the preparation of a stable suspension of mould spores is described, using a strain of *Penicillium* sp. as the test organism. A spore suspension in saline was obtained, surface spores and debris being rejected. The suspensions were examined microscopically to determine the variation in the distribution of clumps of different sizes. Suspensions made at different times and from different cultures showed similar distribution ratios of spore groups.

For counting viable spores five drops of a dilute spore suspension from standard pipettes were added to 2 ml. of a 5 per cent. malt extract B.P. medium in roll tubes [*R.A.M.*, 27, p. 489], which were incubated for three days at 25° C. This medium proved most satisfactory as it encouraged the formation of the fasciculate colonies essential to the success of the method. The drop number was adjusted to give 150 to 200 colonies per tube.

The authors analyse the errors arising from the method of sampling and conclude that its accuracy, which is of a high order, is not impaired by the presence of clumps of two to 20 spores. Clumps of spores were dispersed by forcing the spore suspension from an atomizer at a pressure of 23 lb. per sq. in. against the internal surface of a glass tube held 5 mm. from the nozzle. A comparison of samples showed that no change in the state of the spores, isolated or clumped, takes place during the period over which the samples are taken.

Ochrona roślin. [Plant protection.]—491 pp., 1 col. pl., 296 figs., Puławy, Książnica Rolúicza, 1946. [Received July, 1949.]

This comprehensive, copiously illustrated manual of the Polish Plant Protection Service, to which many authors have contributed, deals in popular terms with diseases and pests of all cultivated crops, vegetables, fruits, and ornamentals, and

imparts general information on the causes of plant diseases. Agricultural, physical-mechanical, biological, and chemical control methods are discussed, together with the apparatus required. The book concludes with chapters on quarantine and legislation.

Schenk (E. T.) & McMasters (J. H.). **Procedure in taxonomy.**—vii+93 pp., Stanford, California, Stanford University Press; London, Geoffrey Cumberlege, Oxford University Press, 1949. $2.50 or 14*s.* net.

This work, originally published in 1936, and now revised and brought up to date (1948) by A. Myra Keen and S. W. Muller, was designed to assist students of zoology and palaeontology to understand taxonomic rules and their application. It includes chapters on systematic categories, types, storage of type material, specific and trivial names, synonymy, the description of new species, Latin terms and abbreviations, and summaries of opinions rendered by the International Commission of Zoological Nomenclature as well as a complete list of the International Code of Zoological Nomenclature. A table of type terms is given (pp. 6–7), comprising types of families and of generic and specific categories. An all-inclusive index is appended.

Du Plessis (S. J.). **Plant diseases and farm planning.**—*Fmg S. Afr.*, 24, 278, pp. 241–242, 1949.

In this paper the author analyses the practical results of losses from plant diseases in South Africa and points out that a crop loss of 5 per cent. in a vineyard may entail a loss of 25 per cent. of the grower's profit.

The teaching of mycology.—*Trans. Brit. mycol. Soc.*, 32, 1, pp. 100–103, 1949.

This report on the teaching of mycology, prepared by a committee appointed by the Council of the British Mycological Society in April, 1945, defines mycology, considers its importance, its relation to botany, and its content. In an Honours course in botany fungi deserve at least one-sixth of the available time. For chemistry Honours a general course (rather than a technical one) in mycology might be a more valuable subsidiary subject than botany or biology. The committee regard it as a basic principle that the study of fungi as a branch of pure science should always precede a study of applied mycology, but in a B.Sc. course the fundamental facts of the economic importance of fungi should receive more emphasis. The consideration of fungi as living organisms is of special importance. Bacteria should have a place in a course on fungi, and their study should include (1) identification by physiological tests, (2) estimation of bacterial numbers (e.g. in soil), and (3) the chief staining methods. Postgraduate work is reviewed and it is pointed out that larger sums of money are required for research. Post-graduate courses should be developed further.

The need for encouraging the study of systematic mycology in England and Wales.—*Trans. Brit. mycol. Soc.*, 32, 1, pp. 104–112, 1949.

This report is presented by a committee appointed by the Council of the British Mycological Society to examine the critical position reached in this country in the study of the systematics of fungi as a result of the shortage of experienced taxonomists and the absence of facilities for training in taxonomy and nomenclature. It traces the history of mycology in England and gives a brief account of the present position of systematic mycology at home and abroad [cf. *R.A.M.*, 23, p. 362]. This is followed by a reasoned statement of the necessity for stimulating the study of the subject at the universities, in the central herbaria, and in laboratories dealing with economic mycology. It is recommended that plant pathologists should

be given more intensive training in mycological taxonomy and provided with facilities for specialization in this subject.

STODDARD (E. M.) & DIMOND (A. E.). **The chemotherapy of plant diseases.**—*Bot. Rev.*, 15, 6, pp. 345–376, 1949.

In this paper the concept of the chemotherapy of plant diseases is taken to include the control of disease by chemicals, however applied, so long as the chemical finds its way into and exerts its ultimate action inside the host plant. No attempt is made to distinguish prophylactic from chemotherapeutic action. The chief points in the history of this method of treatment are reviewed and the modes of chemotherapeutic action with regard to virus, fungus, and bacterial diseases are described. Other sections deal with the methods of introducing chemicals into plants, the distribution of materials injected into plants, control of disease by chemotherapy, and chemotherapeutic studies on Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, 26, p. 429] and on the X-disease of peach [ibid., 27, p. 531]. A bibliography of 106 citations is appended.

VERONA (O.). **Nutrizione e malattie nelle piante coltivate. 2ª edizione.** [Nutrition and diseases in cultivated plants. Second edition.]—vi+222 pp., 18 pl. (7 col.), 7 figs., 17 graphs, Pisa, Arti Grafiche Tornar, 1949. L. 850. $1.50.

This is a second edition, revised and brought up to date, of the author's earlier work on the nutritional disorders of plants [*R.A.M.*, 18, p. 127]. The treatment is on the same lines, but the results of investigations carried out by numerous workers since 1938 have been incorporated, while the extensive bibliography of the earlier edition is omitted. There is an index of subjects and another of authors cited in the text.

REISCHER (HELEN S.). **Preservation of Saprolegniaceae by the mineral oil method.** *Mycologia*, 41, 2, pp. 177–179, 1949.

In work carried out at Columbia University and the New York Botanical Gardens, 67 out of 71 isolates of the Saprolegniaceae have remained viable under mineral oil [*R.A.M.*, 28, p. 230] for varying periods, the longest period of viability up to May, 1948, being 30 months for some isolates of the genera *Achlya*, *Leptolegnia*, and *Saprolegnia*.

SHERBAKOFF (C. D.). **Breeding for resistance to Fusarium and Verticillium wilts.**—*Bot. Rev.*, 15, 6, pp. 377–422, 1949.

After briefly referring to the general features of the wilt-inducing species of *Fusarium* and *Verticillium* and the diseases they cause, the author traces from the literature (of 205 titles) the progress made up to the present day in breeding for resistance to the wilt diseases of a number of economic hosts.

GUBA (E. F.) & SEELER (E. V.). **A troublesome mold and its control in gas-purifying sponge.**—*Econ. Bot.*, 2, 2, pp. 170–177, 4 figs., 1948.

This information about *Sporocybe borzinii* on gas-purifying sponge has already been noticed from another source [*R.A.M.*, 24, p. 109].

ROMANKOVA (Мме A. G.). Антагонизм между плесневыми грибами. [Antagonism between mould fungi.]—Микробиология [*Microbiology*], 17, 2, pp. 132–141, 2 figs., 1 graph, 1948. [Received June, 1949.]

In experiments at the Scientific Research Institute, Leningrad, it was found that under unsterilized conditions a decrease of citric acid production occurred in *Aspergillus niger* cultures which was due to the metabolic products and pronounced antagonism of *Penicillium rugulosum* present in the cultures. This fungus is able

to grow in a 15 per cent. citric acid solution. It is also antagonistic to other species of *Penicillium* and *Aspergillus*, a fact which should be taken into account when antibiotics are being prepared.

Darpoux (H.) & Faivre-Amiot (A.). **Actions antagonistes de divers micro-organismes sur les agents phytopathogènes.** [Antagonistic action of various micro-organisms upon phytopathogenic agents.]—*C. R. Acad. Agric. Fr.*, 35, 7, pp. 266–269, 1949.

The authors describe the methods used and results obtained in a study of the antagonistic action of 143 strains or species of bacteria, actinomycetes, and fungi all of which show some activity against bacteria and fungi pathogenic to plants, part of the study having already been reported [*R.A.M.*, 27, p. 356]. Sunflower plants were protected from infection by *Sclerotinia libertiana* [*S. sclerotiorum*] by various strains of actinomycetes and bacteria antagonistic to the pathogen.

Michener (H. D.) & Snell (Neva). **Two antifungal substances from Bacillus subtilis cultures.**—*Arch. Biochem., N.Y.*, 22, 2, pp. 208–214, 1949.

Bacillus subtilis cultures, grown for subtilin production at the Western Regional Research Laboratory, Albany, California, on asparagus juice, beet molasses, and semi-synthetic media (surface and submerged culture), also secrete at least two other antibiotics [*R.A.M.*, 27, pp. 357, 451]. Unlike subtilin, they are active against fungi but relatively inert towards bacteria. One, termed the *Rhizoctonia* factor, is soluble in water, absolute methanol, and 70 per cent. ethanol, but insoluble in ether, petroleum ether, benzene, ethyl acetate, acetone, butanol, and absolute ethanol. It diffuses through a cellophane membrane. The concentrate was active against 8 out of 11 fungi (*Pythium* sp., *Rhizopus nigricans* [*R. stolonifer*], *Rhizoctonia* [*Corticium*] *solani*, *Sclerotium bataticola* [*Macrophomina phaseoli*], *Sclerotinia fructicola*, *Penicillium digitatum*, *Botrytis cinerea*, and *Alternaria citri*) at dosages ranging from 6·4 (*B. cinerea*) to 470 (*A. citri*) p.p.m., and against one yeast out of seven (*Zygosaccharomyces mandschuricus*) at 33 p.p.m.

The other, designated the *Aspergillus* factor, is insoluble in diethyl ether or petroleum ether but soluble in water, anhydrous butanol, and anhydrous ethanol. It is not diffusible through a cellophane membrane. The concentrate was active against all the 11 fungi tested (comprising, besides the above-mentioned, *Fusarium* [*bulbigenum* var.] *lycopersici*, *A. niger*, and *A. oryzae* at dosages between 3·5 (*M. phaseoli*) and 85 (*F.b.* var. *lycopersici*) p.p.m. Its antagonism towards *Pythium* sp., however, was of a very low order. The *Aspergillus* factor was also active against six out of the seven yeasts tested at concentrations between 11 and 33 p.p.m.

Diehl (W. W.). **Concerning the identity of Iterson's cellulolytic Mycogone.**—*Mycologia*, 41, 3, pp. 277–279, 1949.

A fungus isolated from decaying cotton fabrics a number of times at the Plant Industry Station, Beltsville, Maryland, appeared to be identical with Iterson's *Mycogone puccinioides* (syn. *Blastotrichum puccinioides*), but is identified by the author as *Humicola fusco-atra* after comparison with a culture of this fungus furnished by Dr. S. A. Waksman. No consideration appears to have been given to Iterson's fungus under the name *Humicola* since Traaen (*Nyt. Mag. Naturv.*, 52, pp. 19–121, 4 pl., 1914) suggested it might be the same as his species, *H. grisea*. However, the spores in Iterson's figures appear to measure 7·25 to 8·18 μ, as against 12 to 17 μ for *H. grisea*, while the former measurements are within the range 6 to 9 to 12 μ given by Traaen for *H. fusco-atra*.

The author points out that E. W. Mason (*Mycol. Pap. C.M.I.*, 5, pp. 102–114, figs. 31–44, 1941) considered Traaen's *H. grisea* in Saccardo's *Monotospora* as

a synonym of *M. daleae* Mason and *H. fusco-atra* (described from an ex-type culture and from Waksman's culture) as referable to Corda's *Monotospora*. Mason also suggested that if *Monotospora* Sacc. should be conserved against Corda's prior name, *Humicola* as a synonym of the discarded *Monotospora* Corda would then be legitimate, with *H. fusco-atra* as the type species. This is a convenient taxonomic disposition of this hitherto debated form-genus.

Sen Gupta (S. R.), Nigam (S. S.), & Saxena (B. B. L.). **A new method for the isolation and study of microorganisms from deteriorated textiles.**—*Proc. Indian Acad. Sci.*, Sect. B, **29**, 5, pp. 208–210, 1 pl., 1949.

Considerable practical difficulties are involved in the methods in current use for the isolation of micro-organisms from deteriorated textiles, and a simple new technique has accordingly been devised to overcome them. Fresh test pieces are washed with sterile water to remove superficial contaminants, and replicate strips, $1\frac{1}{2}$ by $1\frac{1}{2}$ in., are cut with sterile scissors and placed, mildewed surface downwards, on clean microscope slides smeared with Mayer's albumen fixative. After 24 hours the strips are peeled off, leaving impression prints on the surface of the slide. One set of slides is mounted in Canada balsam for direct examination. A second set is treated with Gram's stain for the examination of bacteria, and a third is used for the isolation of micro-organisms. The slides are washed with sterile water and placed in a sterile Petri dish. The micro-organisms are then scraped off and washed off the slides with sterile water into a flask from which dilution plates are made on Thornton's agar, nitrate-sucrose agar, and Waksman's media for the isolation of bacteria, actinomycetes, and fungi, respectively. Cellulose-destroying organisms may be readily recognized and isolated by plating in Omeliansky's medium containing cellulose suspension (Fred, E. B., & Waksman, S. A., Laboratory Manual of Microbiology, McGraw Hill Book Company, Inc., N.Y., 1928, p. 69).

Robbins (W. J.) & McVeigh (Ilda). **The 'dual phenomenon' and Trichophyton mentagrophytes.**—*Mycologia*, **41**, 2, pp. 128–140, 1 fig., 1949.

The application of the concept of 'dual phenomenon' [*R.A.M.*, **27**, p. 321] to *Trichophyton mentagrophytes* was tested experimentally at the Department of Botany, Columbia University by growing single-spore isolations of nine variants from a monospore conidial culture obtained from a human subject, together with the original isolate, on various media. Since the variants were obtained from old cultures of the conidial form on which pleomorphic colonies had developed, it was assumed that some of the isolations would be intermediates, as defined by Wilhelm [loc. cit.]. In no case, however, was a conidial or a mycelial type obtained from the microconidia isolated from young cultures of forms which appeared to be intermediate between the two types. Instead the cultures which grew from single microconidia were indistinguishable from the parent. These results indicate that Wilhelm's suggestion is inadequate to explain the variants which develop from a single strain of *T. mentagrophytes*. It is considered that they are mutations, though whether the change is cytoplasmic or nuclear cannot be determined because of the absence of a sexual stage.

Graziosi (F.). **Sulla produzione dei periteci nell' Aspergillus nidulans (Eidam).** [On perithecial production in *Aspergillus nidulans* (Eidam).]—*Riv. Biol.*, N.S., **41**, 1, pp. 109–110, 1949.

Peptone added to culture media at a dosage of 1 per cent. completely inhibited perithecial production in a strain of *Aspergillus nidulans*. Many amino acids (alanine, arginine, leucine, asparagine, histidine, tryptophane, and taurine) behave in the same way as peptone, but both peptone and some amino acids (alanine,

leucine, histidine, tryptophane, and taurine) when used at a low concentration appreciably stimulate perithecial production. In media at pH 6 to 8 (but not at pH 5) adrenalin was rapidly oxidized and the oxidation products stimulated growth and perithecial production.

Fries (N.). **Viability and resistance of spontaneous mutations in Ophiostoma representing different degrees of heterotrophy.**—*Physiol. Plant.*, 1, pp. 330–341, 1 diag., 1 graph, 1948.

A method is fully described and illustrated whereby large-scale isolations of physiological mutants can be made from conidial populations of *Ophiostoma multiannulatum* [*Ceratostomella multiannulata*: *R.A.M.*, 27, p. 379]. Only such mutants are picked up as are characterized by a loss of capacity to fulfil some biosynthetic function. Using this procedure, a comparative study was made of the viability of mutant and 'wild type' conidia. In conformity with previous observations it was found that in a medium devoid of the essential vitamins B_1 and B_6, inoculated with a mixture of conidia from 'wild type' and hypoxanthineless cultures, the latter were the more viable. Most of the mutants isolated from a starvation culture of 'wild type' conidia were lacking in niacin. As the population of living conidia decreased the percentage of mutants among them rose. It appears that the mutant types multiply in the absence of growth substances at the expense of the more sensitive mother strains.

Lilly (V. G.) & Barnett (H. L.). **The influence of concentrations of nutrients, thiamin, and biotin upon growth, and formation of perithecia and ascospores by Chaetomium convolutum.**—*Mycologia*, 41, 2, pp. 186–196, 4 graphs, 1949.

At the Department of Plant Pathology and Bacteriology, West Virginia University, experiments were carried out on the nutrition of *Chaetomium convolutum* [cf. *R.A.M.*, 27, p. 487] which is deficient in thiamine and biotin. The presence of an optimum amount of one of these vitamins promoted growth in proportion to the amount of the other vitamin in the medium. The formation of perithecia and ascospores followed the attainment of maximum vegetative growth provided that the concentrations of these vitamins exceeded certain values. The absolute amounts of thiamine and biotin required for fruiting were a function of the concentration of the nutrients in the medium. The numbers of perithecia and ascospores formed for a given concentration of nutrients increased somewhat as the concentrations of the vitamins were increased; the numbers of mature perithecia formed were more nearly proportional to the concentrations of the vitamins.

Milbrath (J. A.) & English (W. H.). **A late-breaking virus disease of Potatoes.**—*Phytopathology*, 39, 6, pp. 463–469, 2 figs., 1949.

The symptoms of the late-breaking virus disease [*R.A.M.*, 28, p. 237], first observed on the Netted Gem potato variety in Oregon in 1946, present certain analogies with purple top wilt [ibid., 28, p. 480], yellow top [potato apical leaf roll virus: ibid., 8, p. 395; 26, p. 208], witches' broom [ibid., 4, p. 55 *et passim*], haywire [ibid., 28, p. 480], and bunch top [loc. cit.]. However, the following peculiarities of the late-breaking virus will serve to differentiate it from the group of diseases listed: (1) repeated demonstrations of tuber perpetuation for two or more generations; (2) no internal stem or tuber necrosis; (3) the tubers, usually borne on short stolons, are small but not in chains or excessively numerous; (4) profuse production of aerial tubers in the field and aerial tubers and stolons in the greenhouse; (5) uneven distribution of the virus in the tuber; (6) hair sprouts from large tubers but no multiple sprouting or branching; and (7) production, often from the same tuber, of dwarf plants showing acute symptoms early, or apparently normal ones on which the disease develops late in the season.

The initial symptom of the late-breaking virus on Netted Gem is a rolling of the tips of the lateral leaflets very like that associated with purple top wilt. Within a few days the plants assume a stiff, erect habit and the foliage turns olive green to chlorotic. They frequently show a purplish tinge from heavy pigmentation of the leaf veins, the stems, and the small, rolled leaflets in the branch terminals. In the later stages some plants wilt and die, apparently from root starvation and subsequent decay. During the advanced phase of the disease most plants produce aerial tubers often in nearly every leaf axil. On White Rose foliage [in the field] the late-breaking symptoms are not as conspicuous as on Netted Gem and may readily be confused with those of *Rhizoctonia* [*Corticium solani*].

Tubers from severely diseased plants are reduced in size but show no internal discoloration or other pathological features. Many of the larger tubers from infected hills give rise to hair sprouts, sometimes from all the eyes. Netted Gem tubers from late-breaking virus-diseased plants grown in the greenhouse produced plants with very variable symptoms, whereas in White Rose the effects were much more pronounced and included, besides dormant seed pieces, hair sprouts, and weak plants, a profusion of axillary aerial tubers, downward-curving leafy branches, and aerial stolons, with or without tubers attached.

In potato fields several plants were observed with two stalks arising from the seed piece, one with acute late-breaking virus symptoms and small tubers, and the other apparently healthy, with normal tubers. In an experiment one tuber from a diseased and another from a normal stalk, taken from each of ten different hills, were segregated and planted in the greenhouse. All the tubers from the diseased stalks produced infected plants, while those from the normal stalks gave rise to nine healthy plants and one diseased. Of 50 tubers from mildly infected hills, 30 produced apparently normal plants from all four seed pieces, while one to four of the plants arising from the remaining 20 were diseased.

About two months after grafting material from infected on to healthy plants, the latter developed an apical leaf roll and axillary tubers appeared in the upper portions. Inoculated plants turned yellow and the leaves rolled upwards. Plants grown from inoculated Netted Gem tubers invariably showed typical late-breaking virus symptoms, which were absent, however, from the inoculated progeny of White Rose.

MÜNSTER (J.). **La récolte hâtive des semenceaux de Pomme de terre.** [The early harvesting of seed Potatoes.]—*Rev. romande Agric., Vitic., Arboric.*, 5, 3, pp. 17–20, 8 graphs, 1949.

In 1948, early harvesting of seed potatoes (to reduce virus diseases) became obligatory throughout Switzerland in the case of fields for which class A certificate is sought [cf. *R.A.M.*, 27, p. 220]. In 1947, when climatic conditions strongly favoured insect infestation, tests to determine the best date of harvesting were made in four different localities, using Bintje seed from Friesland and Erdgold from Groningen.

In the first locality (two types of soil) harvesting was carried out on 15th and 30th July, 15th August, 8th September, and 2nd October, 1947, while in three other localities the dates were approximately the same. In 1948, the amount of serious virus attack on Bintje rose progressively with each harvesting from 4·7 to 26 per cent. and 2·7 to 32·6 per cent. for the two different soils, respectively, in the first locality. A similar progress in the amount of virus disease was recorded in the other localities, and in all localities also for Erdgold. The results also showed that the minimum period of vegetation required was 70 to 80 days for Bintje and 80 to 90 for Erdgold. To minimize loss of crop weight, pre-germination should be carried out to expedite plant development by 10 to 15 days. Early harvesting is best effected by destroying the haulms.

Graillot (Mlle G.). **Comparaison de la teneur en manganèse et en acide ascorbique des tubercules de Pommes de terre normaux et fileurs.** [A comparison of the manganese and ascorbic acid content of normal and spindly Potato tubers.]—*Ann. agron., Paris*, N.S., 19, 3, pp. 448–451, 1949.

Studies on the manganese and ascorbic acid content of normal potato tubers and those suffering from spindle sprout [cf. *R.A.M.*, 23, p. 454] carried out at the Laboratoire de Chimie Agricole, Grignon, indicated that the trouble was due to manganese deficiency, since the affected tubers contained about 50 per cent. less of this element than normal ones.

Baribeau (B.). **L'indexage des Pommes de terre de semence et les maladies à virus.** [Tuber-indexing of seed Potatoes and virus diseases.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, pp. 138–139, 1 graph, [? 1948].

The tuber-index method for the control of potato virus diseases [*R.A.M.*, 26, p. 559] was used in 1946–47 to examine 45,000 tubers from 40 plots planted by the tuber-unit method in five different regions of Quebec. The results again demonstrated that contamination by mosaic and leaf roll varies with the year, the region, and the locality.

Andreae (Shirley R.) & Andreae (W. A.). **The metabolism of scopoletin by healthy and virus infected Potato tubers.**—*Canad. J. Res.*, Sect. C, 27, 2, pp. 16–22, 1949.

After the removal of chlorophyll, strongly rolled leaves of potato plants infected with leaf roll virus were found to fluoresce over the entire blade a brilliant blue in ultra-violet light [*R.A.M.*, 27, p. 492]; slightly rolled leaves fluoresced mostly only at their tips, while non-rolled leaves, healthy potato plants, and those infected with mild mosaic [potato virus X], rugose mosaic [potato virus Y], or spindle tuber viruses did not fluoresce at all. An accumulation of starch was found almost invariably in the areas that fluoresced. The fluorescent substance when isolated from the leaves had the same fluorescent and solubility properties as scopoletin [loc. cit.]. After submerging healthy and infected tuber slices in a scopoletin solution the tissues became fluorescent, but after some time there was a loss of fluorescence from both tissue and solution, indicating that the scopoletin was being destroyed. This was accompanied by the appearance on the surface of the tissue of dark blue spots which later turned yellow. The loss of scopoletin was accelerated by hydrogen peroxide and inhibited by heating the tissue to 65° C., by cyanide, azide, hydroxylamine, and hydrogen sulphide. Healthy tubers metabolized scopoletin more rapidly than infected ones.

Hutton (E. M.). **Increasing the infectivity of the spotted wilt virus.**—*J. Aust. Inst. agric. Sci.*, 15, 1, pp. 43–44, 1949.

Of various chemicals used at the Bureau of Plant Industry, Canberra, in an attempt to increase the infectivity of the tomato spotted wilt virus, only sulphanilamide was effective. By grinding 1 gm. of leaf from infected young tomato plants with 20 ml. of a 0·1 per cent. aqueous solution of the chemical, with or without a phosphate–sodium sulphite buffer, the lesions on half leaves of inoculated *Nicotiana glutinosa* plants were increased from 19·3 (water control) to 51·9 (without buffer) and 84·5 (with buffer). After one hour, however, the stimulating effect of sulphanilamide was completely lost (12·1 lesions). The increased infectivity was not sufficient to cause systemic invasion of potato plants in hand inoculations.

Hutton (E. M.) & Oldaker (C. E. W.). **Rosette, a virus disease of the Potato in Tasmania.**—*J. Aust. Inst. agric. Sci.*, 15, 1, pp. 25–31, 3 figs., 1949.

In Tasmania, Bismark, Brownell, and Up-to-Date (Factor) potatoes have been found repeatedly infected with a virus disease, known locally as 'rosette' [*R.A.M.*,

6, p. 147]. The same disease was observed in New South Wales on Factor. It is of no economic importance in certified potato crops, affecting only 0·1 to 0·5 per cent. of the plants, and shows no evidence of increasing.

The infected plants are not more than 12 in. high; the leaves are dwarfed and curled, with crinkled, upturned margins. The stems tend to be thick and woody. Such plants produce only one or two sometimes misshapen tubers of no commercial value. In midsummer the infected plants grow more rapidly, but still with wavy leaves.

Rosette was not transmitted by true seed, but the tuber progeny of infected Brownell potatoes all produced plants with rosette symptoms throughout two generations. It appears that once the virus becomes established in the tubers, it persists in all succeeding vegetative progeny.

Rosette was readily transmitted by grafting from potato to tomato and tobacco, from tomato to tomato, tobacco, and in one case to Carman potato, and from tobacco to tobacco and tomato.

A modification of Sheffield's technique [ibid., 22, p. 447] was used to determine histological changes in the stems of infected Brownell potato and Bonny Best tomato. Characteristic circular hyperplastic necrotic areas were found to be confined to the internal and external primary phloem. Rosette resembles most closely green dwarf [ibid., 26, p. 75].

WADE (G. C.). **An unusual Potato rot.**—*J. Aust. Inst. agric. Sci.*, 15, 1, pp. 42–43, 1 fig., 1949.

In August, 1947, Bismark potato tubers grown in the Parattah district, Tasmania, exhibited unusual rot symptoms. Though the disease was not widespread, 50 per cent. of tubers from an infected area were unmarketable. The circular lesions were sunken, with the skin stretched tightly over them. Internally, there were sharply defined dry and powdery rotted areas. In most cases powdery scab (*Spongospora subterranea*) [*R.A.M.*, 27, p. 579] occurred in the centre of the lesions; but if not, the lesions centred around an enlarged lenticel. The fungus constantly isolated from the lesions was identified by Mr. E. W. Mason as *Colletotrichum atramentarium* [ibid., 2, p. 390]. Its black sclerotia are 300 to 500 μ in diameter, and the conidia, usually biguttulate but sometimes containing up to five oil drops, measure 20 to 56 by 4 to 12 μ (mostly 25 by 6 μ).

Inoculated Bismark tubers developed after four days lesions which were similar to those on naturally infected tubers. The results of another test indicate that some form of injury is necessary for infection. In the field it is usually a powdery scab lesion, or sometimes the pathogen may enter through enlarged lenticels induced by excessively wet conditions.

The control of powdery scab and the avoidance of areas liable to waterlogging would help to control the disease. Crop rotation and clean seed are also advised.

DOWNIE (W. A.). **Seed Potato certification. List of growers, 1949.**—*J. Dep. Agric. Vict.*, 47, 5, pp. 211–212, 1949.

In the introduction to this list of growers of certified seed potato crops [cf. *R.A.M.*, 27, p. 491] in Victoria, it is stated that during the current season conditions have been particularly favourable for the multiplication and spread of *Bacterium* [*Xanthomonas*] *solanacearum* [loc. cit.] with the result that many growers whose crops normally achieve the standards required are not included in this list. It is becoming increasingly evident that the varieties Sebago and Sequoia offer little or no resistance to this disease. The planting of clean seed in clean land must be combined with rigid sanitation practices to prevent the introduction of the disease. In the Central Highlands the incidence of bacterial wilt and the [tomato] spotted

wilt virus [ibid., 27, p. 380] is threatening the future certification of all varieties except Snowflake.

Hooker (W. J.). **Parasitic action of Streptomyces scabies on roots of seedlings.**—*Phytopathology*, 39, 6, pp. 442–462, 4 figs., 1949.

At the Iowa Agricultural Experiment Station the host range of *Streptomyces* [*Actinomyces*] *scabies* on seedling plants was investigated, using sterilized inoculated peat soil, infested quartz sand, and soil agar [*R.A.M.*, 27, p. 294]. Four cultures of the fungus caused severe necrosis, especially at the root tips, and generally precluded lateral root development of soy-bean, pea, wheat, radish, and beet, whereas maize showed slight and cucumber considerable tolerance. Isolates of *A.* sp. which were non-pathogenic to potatoes proved equally innocuous to the above-mentioned plants. Besides those listed, Markton oats, *Avena strigosa*, *A. byzantina*, winter and spring barley, *Hordeum nodosum*, *H. distichon* (Spartan variety), *H. bulbosum*, Mida and an unnamed winter wheat, *Triticum durum*, *T. timopheevi*, and Balbo rye, eggplant, tomato, carrot, parsnip, and potato seedlings gave susceptible reactions to *A. scabies*, whereas cucurbits in general were highly resistant.

Virulent cultures of *A. scabies* penetrated the epidermal and cortical cells of wheat and radish roots. Hyphae were much more plentiful in the rhizosphere than in the medium a short distance away. Aqueous extracts of such cultures were no more toxic to wheat roots than those of cultures non-parasitic to potato. *A. scabies* was equally virulent on wheat roots over a wide range of initial inoculum concentrations, and the growth response was constant where planting was delayed by up to eight days.

Of 60 cultures of *A.* spp. tested on wheat, only the agent of sweet potato soil pox (*A. ipomoea*) [see above, p. 514], and the potato scab organism were parasitic. The effects of *A. ipomoea* were similar to those of *A. scabies*, but less severe. Cultures of 13 members of the Eubacteriales failed to induce root necrosis of seedlings growing in agar.

Campagna (E.) & Généreux (H.). **Résistance des variétés de Pommes de terre à la brûlure tardive et à la gale commune.** [Resistance of Potato varieties to late blight and common scab.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, p. 40, [? 1948].

In preliminary varietal resistance tests carried out in Quebec in 1944 Sebago, King, Red Dakota, and Rural Blush potato tubers showed at harvest, respectively, 2·6, 4, 5·1, and 9 per cent. blight [*Phytophthora infestans*]; of these Sebago and King were the only ones whose foliage was not completely destroyed by the fungus. Tubers of Irish Cobbler, Sequoia, Green Mountain, Houma, Warba, and Halles de Paris were severely affected, having 28 to 90 per cent. infection. All these varieties differed in their resistance to common scab [*Actinomyces scabies*: *R.A.M.*, 26, p. 414]. The number of tubers attacked was in most cases high, but the severity of the infection on the individual tubers very low. Red Dakota, Carmen No. 1, and Warba were very susceptible.

Campagna (E.) & Généreux (H.). **Expérience sur les pulvérisations des Pommes de terre, 1944.** [An experiment on Potato spraying, 1944.]—*Rep. Quebec Soc. Prot. Pl., 1945–1947*, pp. 26–39, 1 map, 1 graph, 3 plans, [? 1948].

The results are presented of a preliminary experiment on spraying against potato blight [*Phytophthora infestans*] carried out in 1944 in three widely separated localities in Quebec, using seven applications of Bordeaux mixture (4–4–40 or 2–1–40) or N. I. perenox on the Green Mountain variety. At Nicolet, the only locality where blight developed to any degree, the percentage of affected foliage

on 15th September was 25, 33, and 44 for the three treatments, respectively, compared with 97·5 and 100 for controls not treated with fungicide, while the numbers of affected tubers, in minots (1 minot = 39 l.) per acre, were 40·8, 71·2, and 31·6, respectively, for the treated and 76 for the untreated. In all three localities Bordeaux mixture at each concentration and perenox resulted in significant increases in yield as compared with the controls. The experiment is to be continued.

Campagna (E.) & Généreux (H.). **Essais de protection des Pommes de terre in 1945.** [Experiments on the protection of Potatoes in 1945.]—*Rep. Quebec Soc. Prot. Pl. 1945–1947*, pp. 77–78, [? 1948].

During 1945, when a light infection of early and late blight [*Alternaria solani* and *Phytophthora infestans*: see preceding abstract] occurred, potatoes, in three different areas in Quebec, were given seven applications of Bordeaux mixture (4–4–40 and 2–1–40) and perenox. The average yields (all three localities together) for the different treatments were, for Bordeaux 232·7 and 200·8, for perenox 199·4, and for two controls 161·1 and 164·8 minots per acre.

Wallin (J. R.) & Waggoner (P. E.). **The influence of weekly cumulative rainfall and temperature on Potato late blight epiphytotics in Iowa.**—*Plant Dis. Reptr*, 33, 5, pp. 210–218, 13 graphs, 1949. [Mimeographed.]

Analysis of the rainfall data for six localities in northern Iowa in relation to outbreaks of potato blight (*Phytophthora infestans*) [see above, p. 484] indicated that under Iowa conditions a critical cumulative rainfall line does not differentiate blight from non-blight years. Meteorological factors, such as critical weekly mean cumulative rainfall and critical weekly mean temperature were not, in themselves, effective in separating years of severe blight from years in which only a trace was present, or years with blight from years with no blight. It appears that other factors in combination with temperature and rainfall should be considered in formulating accurate blight forecasts.

Wilson (A. R.) & Boyd (A. E. W.). **A simple power-operated atomizer for applying small quantities of concentrated spray fluids.**—*Phytopathology*, 39, 5, pp. 412–414, 1 diag., 1949.

For the application of small quantities (10 to 50 ml.) of concentrated tar acid herbicides [cf. *R.A.M.*, 27, p. 433] to potato haulms in plots of six plants each [as a measure of control against *Phytophthora infestans*: ibid., 26, p. 561], a small atomizer of the scent spray type was devised, using as interchangeable containers the 6 by $\frac{7}{8}$ in. boiling tubes in which the measured quantities of the sprays were carried to the field. The exhaust gases from a motor were conveyed to the plots through a hose pipe and provided a convenient source of pressure. Details of the construction of the atomizer are given.

Muncie (J. H.). **Reaction of hybrid Potato varieties to infection by Fusarium eumartii.**—Abs. in *Amer. Potato J.*, 26, 3, p. 100, 1949.

Of several seedling selections and commercial varieties tested in the greenhouse in Michigan for resistance to *Fusarium* [*solani* var.] *eumartii* [*R.A.M.*, 27, p. 86; 28, p. 193, and next abstract], only Katahdin failed to exhibit foliage symptoms of the disease. A selection of the cross Chippewa × Menominee showed only very slight symptoms. In field trials on heavily infested soil Teton showed least tuber infection. Most of the seedling selections and commercial varieties showed tuber infection ranging from 21 to 40 per cent.; unnamed hybrid selections from the crosses 627–618 × Ostragis and Hindenburg × Katahdin, seedling 627–126 (U.S.D.A.) and Menominee had 11 to 20 per cent. infected tubers.

MUNCIE (J. H.). **Reaction of Potato varieties to infection by Fusarium eumartii Carpenter.**—*Quart. Bull. Mich. agric. Exp. Sta.*, 31, 3, pp. 270–274, 1949.

Field and greenhouse tests of potato varietal resistance to *Fusarium* [*solani* var.] *eumartii* [see preceding abstract] in Michigan showed that, reaction to tuber infection being graded at 10 per cent. intervals, Teton was outstanding in resistance. Varieties in grades 11 to 20 per cent. included, in addition to those already noted, unnamed seedling selections from Sebago × 528–170, 528–274 × 627–218, and Pontiac. These results promise considerable progress in control by breeding.

AGARWAL (S. C.). **Storage diseases of Potatoes. 1. The role of Fusarium oxysporum Schlechtendahl in the rot of Potatoes.**—*J. Indian bot. Soc.*, 28, 1, pp. 50–62, 2 figs., 1949.

Recently in one year alone a valuable quantity of seed potatoes was lost owing to disease at the Indian Cold Storage Plant, Hapur. Of several fungi isolated from diseased material only *Fusarium oxysporum* [*R.A.M.*, 16, p. 231; 28, p. 193] was found to parasitize the tubers. However, this pathogen is not known to be parasitic at the temperature maintained at the Plant (below 10° C.).

In inoculation experiments, four days after the tubers were artificially infected with *F. oxysporum* (at 20° to 25°) a circular area about 1 cm. in diameter around the point of infection showed a marked depression followed by shrivelling of the skin. The diameter of the ring increased during the next few days until, after ten days' incubation, mycelium appeared on the surface of the tuber. The final stage of decomposition followed soon after. Inoculated tubers kept at 5° and 10° showed no signs of rot after 20 days. In culture the optimum temperature for the germination of the micro- and macroconidia ranged from 25° to 27° and for mycelial growth between 18° and 20°. Growth and germination of the conidia ceased at 35° and 40°, respectively, and neither took place at 5°.

The pathogen was shown to be a wound parasite and unable to parasitize the tubers at any temperature when there was no wound, even when moisture was supplied with the inoculum. In potatoes wounded by scratching the periderm the parasitism of the fungus was confined to 25° and 30°. Moisture accelerated infectivity.

It was found that supplying continuous aseptic air free from carbon dioxide to individually inoculated ripe and unripe Pahari tubers stored in bulk for 60 days at 20° to 25° had no significant effect on the pathogenicity of *F. oxysporum*. The number of rotted ripe and immature non-wounded tubers was greater among the aerated than the non-aerated. Ripe Pahari tubers proved more susceptible to the fungus than the unripe ones. The sprouts of the infected tubers shrivelled and eventually fell off. When, however, a continuous supply of air free from carbon dioxide was given to tubers stored in bulk at 20° to 25° with infection foci of rotting Pahari tubers inoculated with *F. oxysporum*, the disease percentage in the non-aerated was over 12 times in Pahari and 3 times in Gola tubers more than in the aerated chambers.

When respiratory products from potato tubers were passed into flasks containing *F. oxysporum* growing in culture media, some inhibition of growth occurred when the respiratory products were allowed to accumulate slowly in the flasks containing the growing mycelium.

The incidence of this disease in storage may be reduced by thoroughly washing and sterilizing tubers prior to storage and by removing those obviously diseased. Attacks could also be minimized greatly by lowering the temperature of the bins to 5° as rapidly as possible without storing the tubers in the ante-room and by modifying the bins to reduce the number of tubers stored.

ZACHA (V.). **Příspěvek k poznání houby Alternaria porri f. solani Neerg., zvláště ve vztahu k infekci hlíz Bramborových.** [Contribution to the knowledge of the fungus *Alternaria porri* f. *solani* Neerg., especially in relation to the infection of Potato tubers.]—*Acta Univ. Agric. Silvic. Brno, R.Č.S.*, 44, 27 pp., 2 figs., 3 graphs, 1948. [English summary.]

Because of the increasing importance of early blight in potato crops in Czechoslovakia, the author carried out physiological studies on tuber infection by the causal fungus, *Alternaria porri* f. *solani* [*A. solani*: *R.A.M.*, 20, p. 417; 25, p. 581].

While the disease occurs practically all over the world, tuber infection has so far been reported only from the United States, Canada, Holland, North Caucasus, India, Cyprus, Turkey, Chile, Peru, Australia, Denmark [ibid., 24, p. 469], Germany, and Switzerland.

No striking differences were observed among isolates from infected leaves of Bintje, Voran, and Ackersegen potatoes. The quantity of agar had a marked effect on the colour of the submerged mycelium; with 6, 12 and 18 c.c. of agar, the colours were yellowish white, olive green, and dark yellowish brown, respectively. At temperatures between 6° and 30° C. the colour of the submerged mycelium varied from white to red-brown and black. The findings of the earlier authors that the pigment of the mycelium in the culture is an indicator of pH of the substrate were confirmed.

Light appears to be a more important factor in zone formation in cultures than temperature, but both together, under natural conditions, they exerted a most conspicuous effect. Cultures left by a window in the laboratory showed between the fifth and eighth days regular increases of one zone a day. Later, the formation became irregular. The dark zone appeared to be formed during the day under favourable light and temperature conditions, but further investigations are required to confirm this.

The results of tuber infection experiments showed that the wrapping of healthy tubers in diseased leaves did not induce infection; healthy or slightly injured tubers likewise did not give reliable results. When, however, the inoculum was placed on the cut surface or on more severely injured tubers, infection occurred in all cases. The heaviest infection occurred at temperatures of 24° to 27° [cf. ibid., 20, p. 417]. In other experiments potato sprouts 5 to 30 mm. long were inoculated with the mycelium of a strain isolated from Ackersegen at a temperature of 19° to 23°. Half of the sprouts were injured with a sterile glass needle, the other half left uninjured. After 14 days 50 per cent. of the uninjured sprouts exhibited browning at the point of infection whereas 90 per cent. of the injured sprouts became black and died off.

SÉLARIÈS (P.). **Sensibilité des différentes variétés de Pommes de terre à la maladie verruqueuse (Synchytrium endobioticum (Schilb.) Perc.).** [The susceptibility of various Potato varieties to wart disease (*Synchytrium endobioticum* (Schilb.) Perc.).]—*Ann. Épiphyt.*, N.S., 14, 2, pp. 103–109, 2 pl., 1948.

In experiments carried out in Alsace, various potato varieties were classified according to their reaction to *Synchytrium endobioticum* [see above, p. 481]. According to the variety the invaded cells reacted to infection more or less strongly by immediate necrosis or by necrosis of the cells surrounding the part attacked. In resistant varieties the parasite is then eliminated while in susceptible varieties it develops freely in the host tissues.

The first group comprises highly resistant varieties such as Ackersegen and Ovalgelbe in which the parasite is eliminated very rapidly. The second group includes sufficiently resistant varieties such as Johanna in which the parasite is eliminated slowly but completely in the great majority of cases. The third group consists of 'doubtful' varieties such as Ursus, Triumph, Roland I, and Agnès, which register a slow and incomplete reaction. The parasite may be eliminated in

the majority of cases but it may persist in a considerable number. Usually no warts are formed. The fourth group comprises highly susceptible varieties in which the sori generally develop unhindered and warts of various sizes are formed according to the variety concerned and ecological conditions.

RAEDER (J. M.). **Ring rot of Potatoes.**—*Amer. Potato J.*, 26, 4, pp. 126–131, 1949.

In investigations in Idaho into potato ring rot (*Corynebacterium sepedonicum*) [see above, p. 486] with special reference to rate of increase it was found that the picker type of planter is an efficient means of spreading the organism. It gave in two replications disease ratings of 7 and 53 for clean, single drop seed and 35 and 31 for clean cut seed, whereas seed planted with an infested assistant-feed planter gave no infection whatever.

The value of using seed stock free from infection was also demonstrated. Thus with 3 per cent. infected tubers in the stock there were 72·4 per cent. diseased hills in 1944 and 38 per cent. in 1946, the corresponding figures for 5, 7, and 9 per cent. being 88·9 and 44, 84 and 50, and 84·3 and 58.

Lack of aerial symptoms was not sound evidence of absence of infection, 85 hills with no visible symptom giving a positive stain for the disease.

The reductions in yields from stands containing 0, 10, 20, 40, 50, 60, 70, 80, 90, and 100 per cent. affected hills were 0, 10·5, 32·6, 28·2, 39·8, 37·6, 34·8, 56·3, 62·4, and 77·3 per cent. in 1945, the corresponding figures for 1946 being 0, 5·9, 1·1, 22·2, 31·9, 27, 57·3, 57·3, 70·9, and 77·3 per cent. Clearly losses are not necessarily in direct proportion to the percentage of hills affected; a stand 100 per cent. infected can produce 25 per cent. of the yield of a healthy stand.

RICHARDSON (L. T.) & PHILLIPS (W. R.). **Low temperature breakdown of Potatoes in storage.**—*Sci. Agric.*, 29, 4, pp. 149–166, 2 pl., 3 graphs, 1949.

This is a full account of studies a preliminary account of which has already been noted [*R.A.M.*, 27, p. 335].

VERONA (O.). **Elementi di microbiologia pedologica.** [Elements of soil microbiology.] — x + 586 pp., 106 figs. (one folding), 65 graphs, 12 diags., Firenze, L. Macrì, Editore, [? 1949]. L. 2,800.

This comprehensive, copiously illustrated work presents a co-ordinated account of all those matters which are comprised under the heading of soil microbiology. Part one (pp. 1–138) covers the processes of soil formation, the physical and chemical properties of soil, its microbial population, the micro-organisms of the air, and water purification; part two (pp. 141–393) deals, *inter alia*, with root symbionts of the Leguminosae, nitrification and denitrification, the microbial decomposition of carbohydrates, pectin, chitin, and glucosides, lipides, alcohols, acids, hydrocarbons, and of sulphur, iron, and mineral compounds; part three (pp. 397–540) covers root-inhabiting microflora, the microbiology of rotation, fertilizers, manuring, and soil sterilization and its relation to soil fertility. Author and subject indexes are provided and one for a list of the most important techniques.

SWABY (R. J.). **The relationship between micro-organisms and soil aggregation.**—*J. gen. Microbiol.*, 3, 2, pp. 236–254, 2 pl., 2 graphs, 1949.

In experiments carried out at Rothamsted Experimental Station, the relative aggregating power of pure cultures of micro-organisms [*R.A.M.*, 27, p. 383] was as follows: fungi > actinomycetes and a few gum-forming bacteria > most gum-producing bacteria > yeasts, proactinomycetes, and many bacteria. The last three groups did not improve aggregation. A few bacterial strains produced gums capable of glueing soil into water-stable aggregates and stabilizing the

aggregates produced from completely dispersed soils and kaolin, but not those formed with bentonite or ferric hydroxide.

Mixed cultures of fungi or of actinomycetes gave slightly better aggregation than pure cultures, while more complex mixtures containing fungi, bacteria, and actinomycetes gave good aggregation when all micro-organisms were compatible.

The temporary improvement in soil structure after the addition of organic materials can be partly explained by the action of microbes.

WIEHE (P. O.). **Results of some experiments on smut of Sugarcane in Mauritius.**—*Rev. agric. Maurice*, 28, 1, pp. 7–11, 2 graphs, 1 diag., 1 map, 1949.

Sugar-cane smut (*Ustilago scitaminea*) [*R.A.M.*, 27, p. 542; 28, p. 421] is one of the major diseases of the crop in Mauritius, though its importance is overshadowed by the fact that M: 134/32, the chief variety in commercial plantings, is highly resistant. Epidemics occur only in areas below 300 ft.

In a trial carried out with DK/74, BH 10/12, and white Tanna planted in October, 1938, and wounded and infected [ibid., 23, p. 291] in February, 1939, it was found during 1939–40 that the disease reached maximum severity (expressed as number of infected stools and shoots) during the warmer part of the year, 45 per cent. of the stools showing infection in March and none in July or August. The period of lower intensity coincided with the dry season (June to November). It is high temperature, not lack of moisture which favours infection, though drought may aggravate it.

To study the effect of planting material on incidence, in July, 1940, 120 BH 10/12 cuttings from a smut free locality (Reduit) and 120 from an affected one (Labourdonnais) were planted in alternate plots. Of the latter 27 became affected, though of the former only six were attacked. It was also found that there was a marked difference in the course of the disease according to place of origin. Thus, two phases were distinguishable, the first with a high percentage of attack three to six months after planting and confined to the plots of cuttings from the infected locality, and a second, seven to ten months after planting, with a smaller incidence and common to both series of plots. Transmission from a diseased to a healthy stool did not appear to occur during the first phase. Also, during the first phase it was always the leading or primary shoots which showed infection; later, the smutted whips were produced either by the leading shoots or by secondary shoots from them. This difference, it is suggested, may be due to latent bud infection, which would appear to be widespread in canes grown in a smut locality. Infection in the second phase probably arises from the air or soil and affects all the stools similarly, irrespective of their origin. These views were confirmed by microscopical examination of lateral buds.

With a susceptible variety, therefore, it is distinctly advantageous to import cuttings from a smut-free area if they are to be planted in an area where the climate favours infection. The resultant reduction in incidence will exercise a beneficial residual effect in ratoon crops.

Nursery stock, plant, and seed quarantine. List of approved packing materials and instructions for their use—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 571, 2 pp., 1949. [Mimeographed.]

Administrative instructions effective as from 1st January, 1949, and superseding *B.E.P.Q.* 365 (7 CFR 319. 37–7a) and *B.E.P.Q.* 369 (7 CFR 319. 37–7b) are issued to approve certain packing materials (including buckwheat hulls, charcoal, coral sand from Bermuda certified by the Director of Agriculture, ground cork, sawdust, and sphagnum moss) that may be employed in connexion with any shipment of restricted plant materials, to prescribe instructions for their use, and indicate situations in which limited modifications may be made where conditions of pest risk permit.